Final
Ocean Discharge Criteria Evaluation
for
General Permit AKG700000 and AKG701000
for
Log Transfer Facilities in State Waters

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1.0 INTRODUCTION

1.1 BACKGROUND

The Clean Water Act (CWA) requires that a state must have the necessary legal authority to administer the National Pollutant Discharge Elimination System (NPDES) Program before the Environmental Protection Agency (EPA) will approve a state's NPDES Program application. On May 1, 2008, the State of Alaska submitted a final application to the EPA for authority to permit wastewater discharges to surface water in Alaska, and on October 31, 2008, EPA approved the application. The Alaska Department of Environmental Conservation (DEC or the Department) assumed full authority to administer the wastewater discharge permitting and compliance program for Alaska on October 31, 2012. The resulting program is called the Alaska Pollutant Discharge Elimination System (APDES) Program. DEC became the permitting and compliance authority for log transfer facilities (LTFs) on October 31, 2008.

1.2 PURPOSE

The DEC re-issued two APDES general permits (GPs) for discharges associated with LTFs in Alaskan state marine waters within the geographic area extending from the Alexander Archipelago west through the central Gulf of Alaska and Prince William Sound, to Kodiak Island (see Figure 1). The general APDES permit coverage does not include Cook Inlet, freshwater habitats (including streams, lakes, rivers, impoundments, and wetlands), or areas that are excluded from authorization. In this document, the geographic area covered by the APDES GPs is referred to as the "Area of Coverage". The GPs are the APDES Log Transfer Facilities in Alaska General Permit (the Post-85 LTF GP, AKG701000) and the APDES Clean Water Act Modifications to Section 404 Permits for Log Transfer Facilities in Alaska Which Received a Section 404 Permit Prior to October 22, 1985 General Permit (the Pre-85 LTF GP, AKG700000).

An LTF is generally defined as a facility which is constructed in whole or in part in waters of the United States and which is utilized for the purpose of transferring commercially harvested logs to or from a vessel or log raft, including the formation of a log raft. An off-shore log transfer facility (or log storage area) is a log transfer facility where logs are moved between a vessel or helicopter and off-shore marine waters, or an off-shore log storage area which is not adjacent to a shore-based LTF. LTFs are usually constructed at tidewater locations to support adjacent upland timber harvest activities. Harvested logs are usually transported to the LTF by truck on the local road network. Logs are unloaded from the truck and processed in the LTF sort yard. Processing includes determining individual log volume (gross and net volume), trimming defective ends, and sorting into log sorts (logs that share similar pre-defined sale characteristics). Bundles of sorted logs are then constructed using wire or metal straps and transferred into salt water at the designated transfer location. Bundles are then towed into log booms (logs chained together), assembled into a log raft, and stored in the vicinity of the facility pending sale or transfer to a sawmill location.

LTFs in Alaska are required to obtain an APDES permit prior to the start of operation. Under the APDES program, GPs are issued in cases where a number of dischargers have similar effluents, similar control measures, and discharge conditions. Owners and operators of an LTF who are not granted written authorization under the GP are not authorized to discharge to the specified waters unless an individual permit has been issued to the discharger.

Section 403(c) of the CWA, adopted by reference at Alaska Administrative Code (AAC) 18 AAC 83.010, requires that APDES permits for discharges into the territorial seas, the contiguous zone, and the oceans, comply with EPA's Ocean Discharge Criteria. The purpose of this Ocean Discharge Criteria Evaluation (ODCE) is to assess the discharges authorized under the LTF GPs, and evaluate the potential for unreasonable degradation of the marine environment.

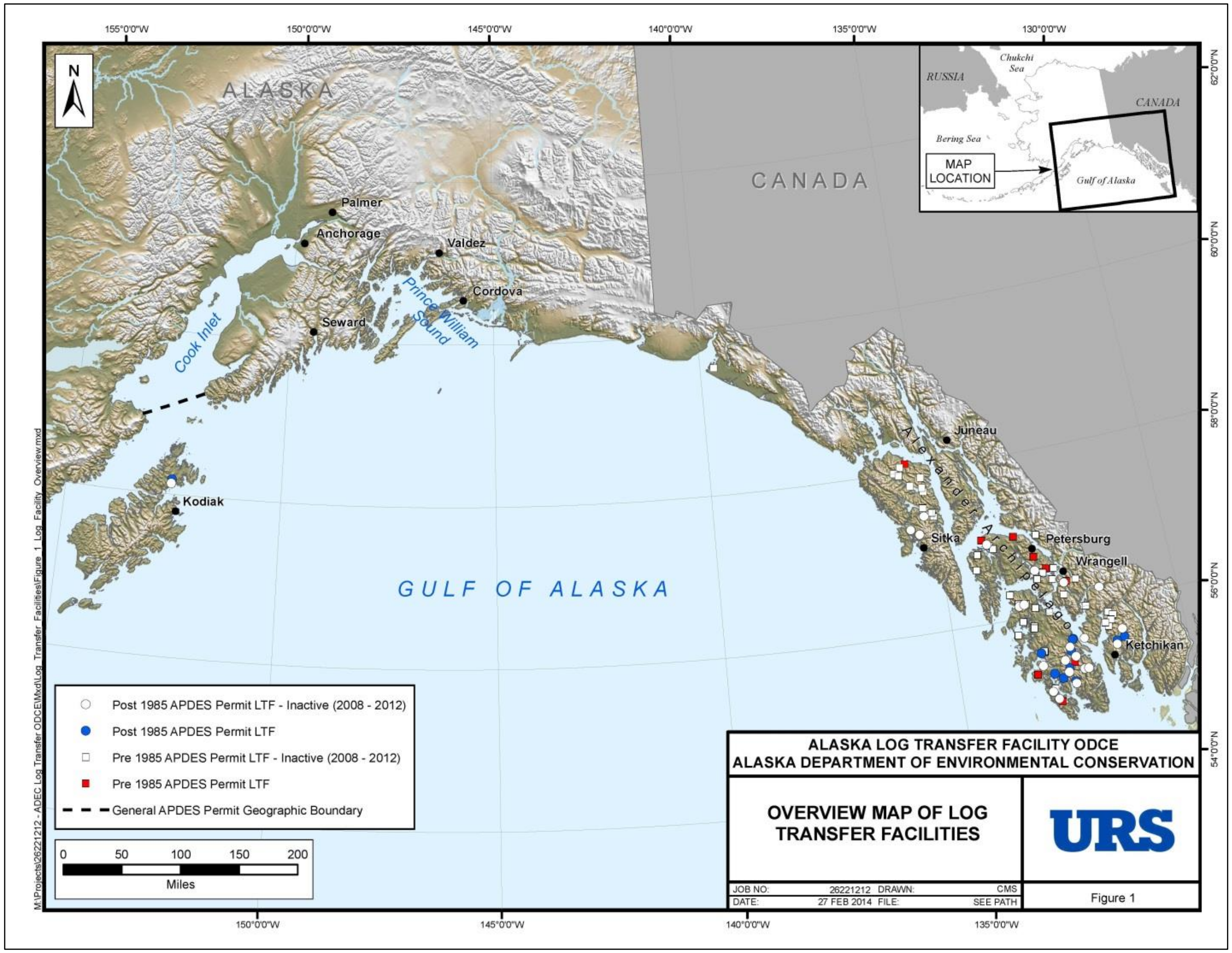

Figure 1. Overview Map of exisiting Log Transfer Facilities in Alaska

Geographic area of the Alaska Pollutant Discharge Elimination System (APDES) general permits that apply to qualifying log transfer facilities (LTFs) discharging bark and woody debris into marine waters within the geographic area of southern Alaska. It extends west from the Alexander Archipelago through the central Gulf of Alaska and Prince William Sound to Kodiak Island. The APDES general permit coverage does not include Cook Inlet, freshwater habitats (including streams, lakes, rivers, impoundments, and wetlands), or areas that are excluded from authorization.

1.3 OCEAN DISCHARGE CRITERIA

EPA's Ocean Discharge Criteria (Title 40 of the Code of Federal Regulations [CFR] Part 125, Subpart M), adopted by reference at 18 AAC 83.010, sets forth the findings that the permitting agency must make before permit issuance with respect to determining whether or not unreasonable degradation of the marine environment will occur as a result of the proposed activity. Unreasonable degradation is defined as follows (40 CFR 125.121(e):

- Significant adverse changes in ecosystem diversity, productivity, and stability of the biological community within the area of discharge and surrounding biological communities;
- Threat to human health through direct exposure to pollutants or through consumption of exposed aquatic organisms; or
- Loss of aesthetic, recreational, scientific, or economic values that are unreasonable in relation to the benefit derived from the discharge.

Determination of unreasonable degradation is to be made based on consideration of the following ten criteria (40 CFR 125.122):

- Quantities, composition, and potential for bioaccumulation or persistence of the pollutants to be discharged;
- Potential transport of such pollutants by biological, physical, or chemical processes;
- Composition and vulnerability of the biological communities that could be exposed to such pollutants, including the presence of unique species or communities of species, the presence of species identified as endangered or threatened pursuant to the Endangered Species Act, or the presence of those species critical to the structure or function of the ecosystem, such as those important for the food chain;
- Importance of the receiving water area to the surrounding biological community, including the presence of spawning sites, nursery/forage areas, migratory pathways, or areas necessary for other functions or critical stages in the life cycle of an organism;
- Existence of special aquatic sites including marine sanctuaries and refuges, parks, national and historic monuments, national seashores, wilderness areas, and coral reefs;
- Potential impacts on human health through direct and indirect pathways;
- Existing or potential recreational and commercial fishing, including finfishing and shellfishing;
- Any applicable requirements of an approved Coastal Zone Management Plan;
- Other factors relating to the effects of the discharge, as appropriate; and
- Marine water quality criteria developed pursuant to CWA Section 304(a)(1).

The DEC will determine whether the LTF GPs may be issued on the basis of the analysis presented in this ODCE. If DEC determines that the discharges will not cause unreasonable degradation of the marine environment, then it may issue an APDES permit. If DEC determines that the discharge will cause unreasonable degradation of the marine environment, then an APDES permit may not be issued. If DEC has insufficient information to determine that no unreasonable degradation of the marine environment will occur, an APDES permit will not be issued unless DEC, on the basis of the best available information, determines the following are true:

- Such discharge will not cause irreparable harm[1] to the marine environment during the period in which monitoring will take place;
- There are no reasonable alternatives to the on-site disposal of the materials; and
- The discharge will be in compliance with additional permit conditions set out under 40 CFR 125.123(d).

Environmental monitoring is required in permits issued under the "no irreparable harm" provision of Section 403(c) of the CWA. The purpose of such environmental monitoring is to collect sufficient information to determine whether or not the marine environment will be unreasonably degraded as a result of the discharge, and to ensure that the marine environment is not irreparably harmed during the permit period of coverage.

1.4 SCOPE OF EVALUATION

This evaluation utilizes information provided in a previous ODCE document (Tetra Tech 2005) prepared to evaluate potential environmental impacts associated with the previous NPDES GP for LTF facilities in Southeast Alaska, and provided in LTF discharge monitoring reports and operational information for the five-year period from 2008 through 2012 available from DEC's Anchorage office. Operational information on a total of 87 LTFs was compiled and evaluated in preparing this ODCE; the location of these facilities within the APDES permit area is shown in Figures 2 through 7. The information presented in this document is a synthesis of these data sources, information obtained from DEC and other agencies, and findings published in the scientific literature.

This evaluation describes the discharges likely to result from the operation of LTFs in the Area of Coverage and provides a qualitative assessment of the relative environmental impact associated with each discharge. The LTFs considered in this report transfer logs from land to water and store logs in water prior to shipment.

1.5 OVERVIEW OF DOCUMENT

This report focuses on sources, fates, and potential effects of pollutant discharges resulting from operation of LTFs in the Area of Coverage.

- Chapter 2 describes the composition and quantities of discharges associated with LTFs in the Area of Coverage.
- Chapter 3 discusses the transport, persistence, and fate of the discharged material.
- Chapter 4 provides an overview of biological communities and important species likely to be present the Area of Coverage.

[1] Irreparable harm is defined as, "significant undesirable effects occurring after the date of permit issuance which will not be reversed after cessation or modification of the discharge" [40 CFR 125.121(a)].

- Chapter 5 presents the mechanisms by which LTF discharges can impact marine life, and the concentrations at which effects have been documented.
- Chapter 6 discusses the potential for LTF operations to adversely impact threatened and endangered species.
- Chapter 7 discusses commercial, recreational, and subsistence harvest of finfish and shellfish within the Area of Coverage.
- Chapter 8 addresses special aquatic sites located within the Area of Coverage.
- Chapter 9 evaluates expected LTF discharges using the State of Alaska and EPA water quality criteria.
- Chapter 10 addresses the 10 criteria specified for determination of unreasonable degradation per 40 CFR 125.122, and evaluates whether issuance of the LTF GPs would cause unreasonable degradation of the marine environment.
- Chapter 11 lists the references used in the preparation of this document.

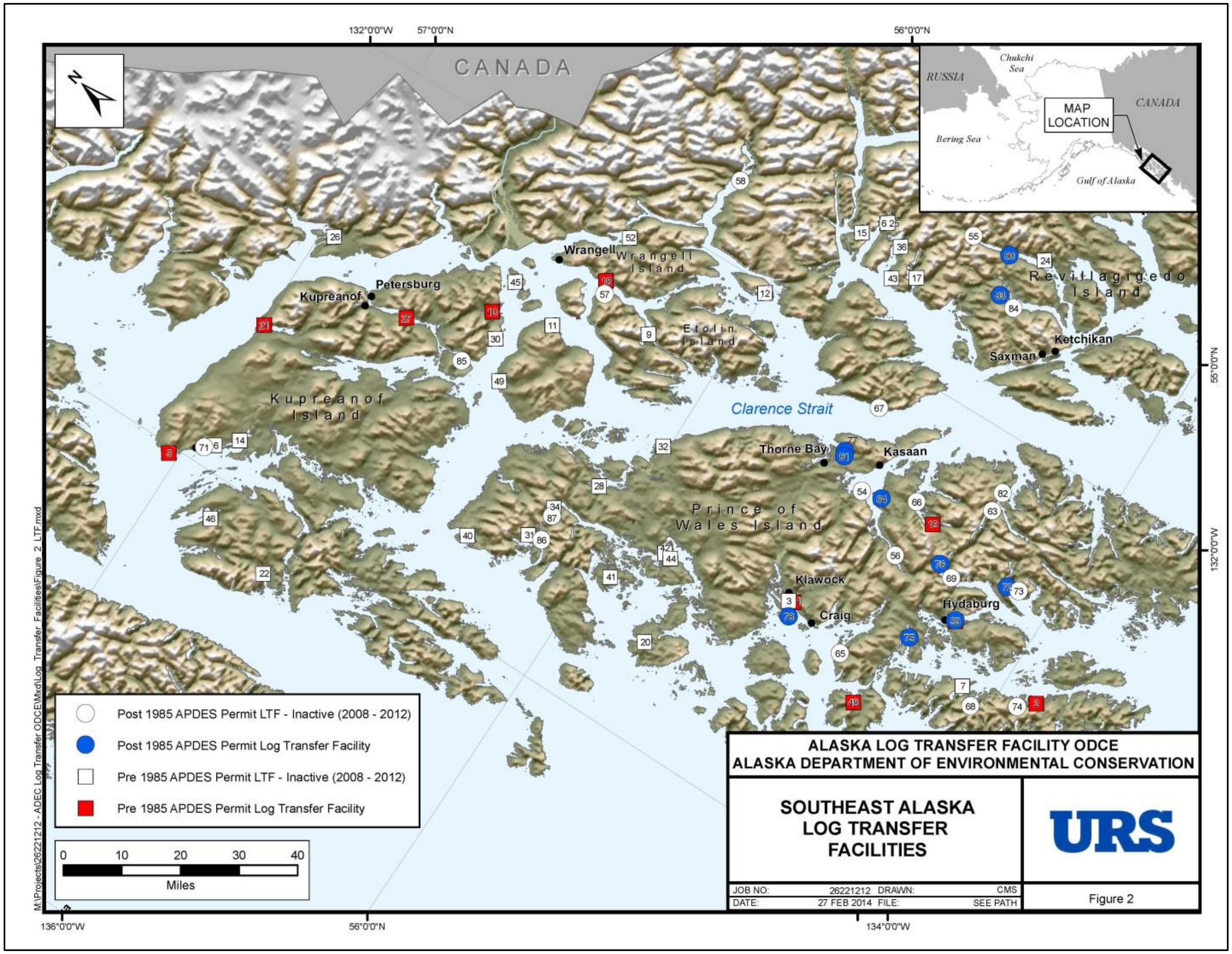

Figure 2. Southeast Alaska Log Transfer Facilities

Log transfer facilities (LTFs) discharging bark and woody debris into marine waters located on Prince of Wales Island and adjacent areas in Southeast Alaska.

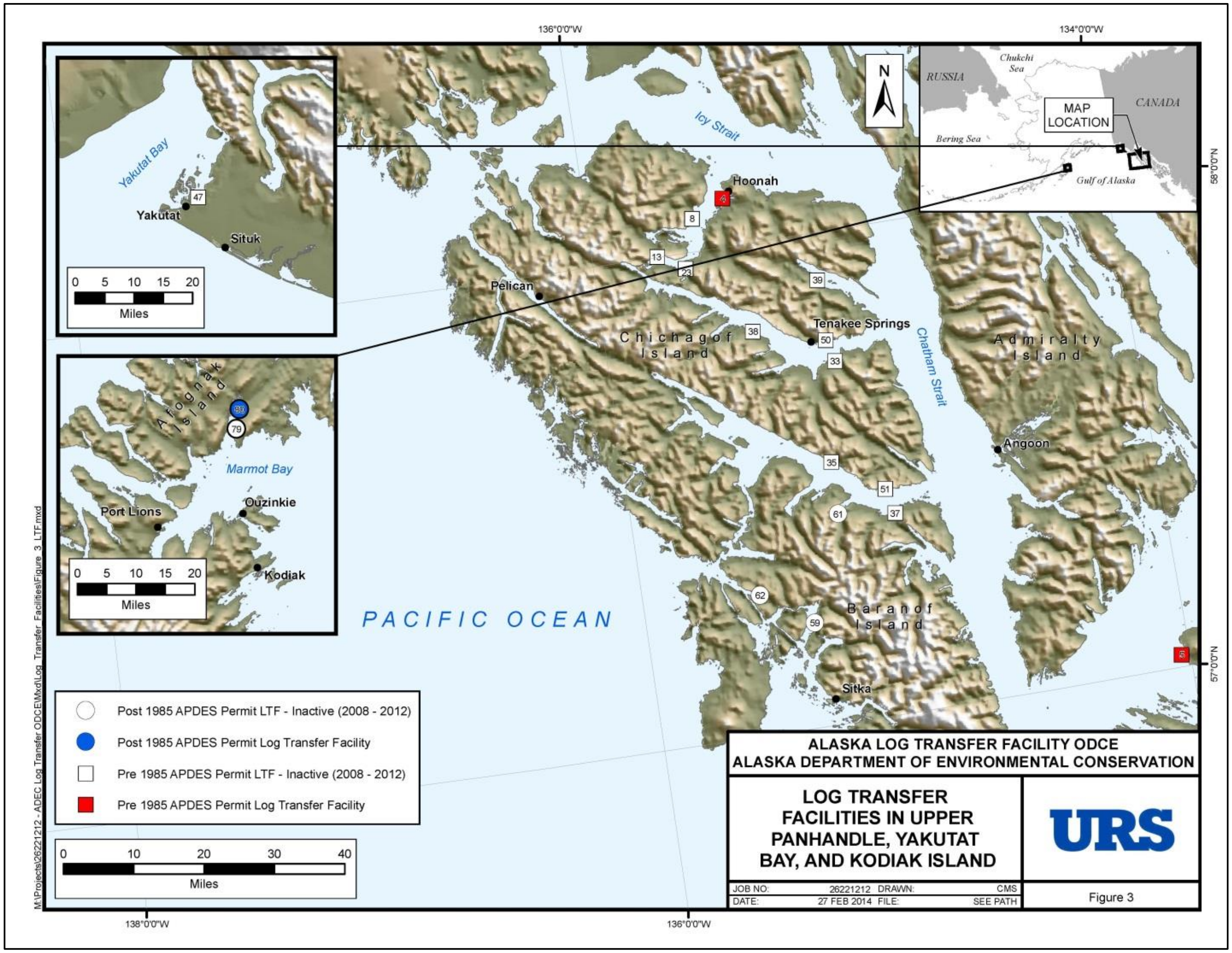

Figure 3. Log Transfer Facilities in Upper Panhandle, Yakutat Bay, and Afognak Island

Log transfer facilities discharging bark and woody debris into marine waters located on the upper Southeast Alaska panhandle, at Yakutat Bay, and Afognak Island, northeast of Kodiak Island.

TABLE 1-1. LOG TRANSFER FACILITIES WITHIN THE AREA OF COVERAGE FOR THE ALASKA POLLUTANT DISCHARGE ELIMINATION SYSTEM GENERAL PERMITS

ID	Permit #	LTF Facility	Post/Pre 1985	Activity (2008 - 2012)
1	AKG700001	Viking Lumber Mill	Pre	Active
2	AKG700002	Grace Harbor LTF	Pre	Active
3	AKG700003	Klawock Island Dock LTF	Pre	Active
4	AKG700004	East Port Frederick -Long Island LTF	Pre	Active
5	AKG700005	Point Macartney LTF	Pre	Inactive
6	AKG700006	Portage Bay LTF and LSA	Pre	Inactive
7	AKG700007	View Cove LTF and LSA	Pre	Inactive
8	AKG700008	West Port Frederick LTF and LSA	Pre	Inactive
9	AKG700014	Anita Bay South LTF	Pre	Inactive
10	AKG700015	Blind Slough LTF	Pre	Active
11	AKG700016	Deep Bay LTF	Pre	Inactive
12	AKG700017	Deer Island West LTF	Pre	Inactive
13	AKG700018	Eight Fathom Bight LTF	Pre	Inactive
14	AKG700019	Hamilton Bay LTF	Pre	Inactive
15	AKG700020	Hassler LTF	Pre	Inactive
16	AKG700021	Klu Bay LTF	Pre	Inactive
17	AKG700023	Marguerite Bay	Pre	Inactive
18	AKG700024	Pats Creek LTF	Pre	Active
19	AKG700025	Polk Inlet LTF	Pre	Inactive
20	AKG700026	Port Alice LTF	Pre	Inactive
21	AKG700027	Portage Bay LTF	Pre	Inactive
22	AKG700028	Rowan Bay LTF	Pre	Inactive
23	AKG700029	Salt Lake Bay LTF	Pre	Inactive
24	AKG700030	Shoal Cove LTF	Pre	Inactive
25	AKG700031	Shrimp Bay LTF	Pre	Inactive
26	AKG700032	Thomas Bay LTF	Pre	Inactive
27	AKG700033	Tonka LTF	Pre	Active
28	AKG700034	Whale Pass LTF	Pre	Inactive
29	AKG700035	Winter Harbor LTF	Pre	Inactive
30	AKG700036	Woodpecker Cove LTF	Pre	Inactive
31	AKG700038	Calder LTF	Pre	Inactive
32	AKG700039	Coffman Cove LTF	Pre	Inactive

TABLE 1-1. LOG TRANSFER FACILITIES WITHIN THE AREA OF COVERAGE FOR THE ALASKA POLLUTANT DISCHARGE ELIMINATION SYSTEM GENERAL PERMITS

ID	Permit #	LTF Facility	Post/Pre 1985	Activity (2008 - 2012)
33	AKG700040	Corner Bay LTF	Pre	Inactive
34	AKG700041	El Capitan LTF	Pre	Inactive
35	AKG700042	False Island LTF	Pre	Inactive
36	AKG700043	Fire Cove LTF	Pre	Inactive
37	AKG700044	Hanus Bay LTF	Pre	Inactive
38	AKG700045	Inbetween LTF	Pre	Inactive
39	AKG700046	Kennel Creek LTF	Pre	Inactive
40	AKG700047	Labouchere Bay LTF	Pre	Inactive
41	AKG700048	Marble Island East LTF	Pre	Inactive
42	AKG700049	Naukati LTF	Pre	Inactive
43	AKG700050	South West Neets Bay LTF	Pre	Inactive
44	AKG700051	Nichin Cove LTF	Pre	Inactive
45	AKG700052	Rynda LTF	Pre	Inactive
46	AKG700053	Saginaw Bay LTF	Pre	Inactive
47	AKG700054	Sawmill Cove LTF	Pre	Inactive
48	AKG700055	Sumez - Refugio LTF	Pre	Active
49	AKG700056	St Johns LTF	Pre	Inactive
50	AKG700057	Indian River LTF	Pre	Inactive
51	AKG700059	Todd LTF	Pre	Inactive
52	AKG700060	Venus Cove LTF	Pre	Inactive
53	AKG700061	Saltery Point LTF	Post	Active
54	AKG701001	Sandy Point LTF	Post	Inactive
55	AKG701002	Carroll LTF	Post	Inactive
56	AKG701004	East Twelvemile LTF	Post	Inactive
57	AKG701006	King George LTF	Post	Inactive
58	AKG701007	Hoya LTF	Post	Inactive
59	AKG701008	Lisa Creek LTF	Post	Inactive
60	AKG701009	Shelter Cove LTF	Post	Active
61	AKG701010	Saook Bay LTF	Post	Inactive
62	AKG701013	St John Baptist LTF	Post	Inactive
63	AKG701014	West Arm Cholmondeley LTF	Post	Inactive
64	AKG701015	Kina Cove LTF and LSA	Post	Active

TABLE 1-1. LOG TRANSFER FACILITIES WITHIN THE AREA OF COVERAGE FOR THE ALASKA POLLUTANT DISCHARGE ELIMINATION SYSTEM GENERAL PERMITS

ID	Permit #	LTF Facility	Post/Pre 1985	Activity (2008 - 2012)
65	AKG701016	Port Caldera LTF	Post	Inactive
66	AKG701027	Little Goose Bay LSA	Post	Inactive
67	AKG701028	Cleveland Peninsula LTF and LSA	Post	Inactive
68	AKG701029	Coco Harbor LTF	Post	Inactive
69	AKG701030	Copper Mountain LTF	Post	Inactive
70	AKG701031	Hydaburg Ship Moorage	Post	Active
71	AKG701032	Kake Ship Moorage and LSA	Post	Inactive
72	AKG701033	Nutkwa Inlet North LTF	Post	Active
73	AKG701034	Nutkwa Inlet South LTF	Post	Inactive
74	AKG701035	Rose Inlet LTF	Post	Inactive
75	AKG701037	Soda Bay LTF	Post	Active
76	AKG701038	Sulzer LTF	Post	Active
77	AKG701039	Tolstoi Bay STC LTF	Post	Active
78	AKG701040	Wadleigh Island LSA	Post	Active
79	AKG701044	Barefoot Beach LTF	Post	Inactive
80	AKG701049	Lookout Cove LTF	Post	Active
81	AKG701053	Tolstoi Bay MHT LTF	Post	Active
82	AKG701057	Sunny Point USFS LTF	Post	Inactive
83	AKG701061	Leask Cove LTF	Post	Active
84	AKG701062*	Pacific Log and Lumber	Post	Inactive
85	AKG701063**	Pothole LSA	Post	Inactive
86	AKG701064*	Shakan Bay LSA	Post	Inactive
87	AKG701065*	East Dry Pass LSA	Post	Inactive

- * Permittee did not submit annual reports for this period.
- ** Permittee for 2008 – 2011 did not submit annual reports. USFS became permittee in 2012 and filed annual report.

2.0 COMPOSITION AND QUANTITIES OF MATERIALS DISCHARGED

The determination of "unreasonable degradation" of the marine environment is based on consideration of ten criteria listed in Section 1.0. The following section provides information pertinent for the consideration of the ocean discharge criterion listed below:

- Criterion #1: The quantities, composition, and potential bioaccumulation or persistence of the pollutants to be discharged.

The quantities and composition of the pollutants that may enter the marine environment as a consequence of LTF operations in southeast Alaska are dependent upon the following factors:

- Quantity of logs transferred;
- Transfer method;
- Species of logs transferred;
- Operational practices.

The quantity of logs transferred is dependent upon the size and level of operational activity of an LTF and determines, in part, the quantities of log-related and other pollutants discharged. The method of transfer used at LTFs has been shown to affect the quantities of bark and associated wood debris that enters marine waters during LTF operations (Tetra Tech 2005). Log transfer methods include the use of cranes, A-frames, slides, chain conveyors, and direct dumping. The species of logs transferred affects factors such as bark loss and the composition and quantities of leachates released to receiving waters. The operating practices (e.g., length of time logs or log bundles are in the water before being moved by tug, effectiveness of bark removal from the sort yard) used at an LTF also influence the quantity and composition of pollutants discharged.

Operators of a Post-85 LTF must submit a Notice of Intent (NOI) to DEC as specified under Part V of the general APDES permit. The NOI is to include the expected facility lifespan; average and maximum volume of timber expected to be transferred per year; and the maximum volume of timber expected to be transferred during the life of the permit. Operators of a Pre-85 LTF must submit a Notification to DEC as specified under Part IV of the general APDES permit. The Notification is to include the expected facility lifespan; average and maximum volume of timber expected to be transferred per year; and the maximum volume of timber expected to be transferred during the life of the permit.

2.1 QUANTITY OF LOGS TRANSFERRED

The volume of logs transferred at a given LTF can be extremely variable from year to year due to the availability of timber and market factors that determine the extent to which a given facility is utilized. LTF GP permittees are required to submit an annual report, for both operating and inactive LTFs that indicates the actual volume of timber transferred, any observed oil sheens in marine waters, other permit noncompliance, and any proposed changes to the permittee's NOI.

Table 2-1 shows the annual volume of logs transferred by shore-based LTFs that were active during at least one year during the five year period from 2008 through 2012. Eighteen LTFs were active during this period, with only three facilities actively transferring logs to water during all five years. The number of individual facilities actively transferring logs during any given year ranged from seven to nine during the five year period from 2008 through 2012 (Table 2-2). The maximum volume of logs transferred in any given year was 131 million board feet of timber (mmbf) in 2010. This value represents the sum of the volumes reported for all facilities in 2010. The annual average volume of logs transferred at individual LTFs during the five year period from 2008 through 2012 ranged from 0.04 to 44.8 mmbf (Saltery Point LTF and Lookout Cove LTF respectively). The total volume of logs transferred over the five year period (2008-2012) at individual LTFs ranged from 0.2 to 224.1 mmbf (Saltery Point LTF and Lookout Cove LTF respectively), with five facilities transferring total log volumes greater than 15 mmbf.

TABLE 2-1. VOLUME (MBF) OF LOGS TRANSFERRED BY SHORE-BASED LTFS (2008-2012)
(MBF represents thousands of board feet of timber)

Permit Number	Facility Name	2008 Volume Transferred (MBF)	2009 Volume Transferred (MBF)	2010 Volume Transferred (MBF)	2011 Volume Transferred (MBF)	2012 Volume Transferred (MBF)
AKG700001	Viking Lumber Mill	1,000	1,500	2,000	0	0
AKG700002	Grace Harbor LTF	29,612	33,181	33,600	12,373	0
AKG700003	Klawock Island Dock LTF	10,550	3,200	0	0	0
AKG700004	East Port Frederick - Long Island LTF	0	0	0	0	8,309
AKG700015	Blind Slough LTF	0	0	469	0	0
AKG700024	Pats Creek LTF	0	0	0	840	1,000
AKG700033	Tonka LTF	5,000	0	0	0	0
AKG700055	Sumez - Refugio LTF	0	0	469	0	0
AKG700061	Saltery Point LTF	0	0	200	0	0
AKG701009	Shelter Cove LTF	5,000	0	0	0	0
AKG701015	Kina Cove LTF and LSA	0	0	0	0	827
AKG701033	Nutkwa Inlet North LTF	0	0	14,500	24,495	14,497
AKG701037	Soda Bay LTF	0	15,325	0	0	0
AKG701038	Sulzer LTF	1,318	12,975	18,150	8,167	960

TABLE 2-1. VOLUME (MBF) OF LOGS TRANSFERRED BY SHORE-BASED LTFS (2008-2012)

(MBF represents thousands of board feet of timber)

Permit Number	Facility Name	2008 Volume Transferred (MBF)	2009 Volume Transferred (MBF)	2010 Volume Transferred (MBF)	2011 Volume Transferred (MBF)	2012 Volume Transferred (MBF)
AKG701039	Tolstoi Bay STC LTF	0	0	0	10,987	27,122
AKG701049	Lookout Cove LTF	33,670	39,347	45,706	51,300	54,148
AKG701053	Tolstoi Bay MHT LTF	0	0	0	0	2,500
AKG701061	Leask Cove LTF	3,087	5,643	9,692	4,341	7,757

TABLE 2-2. NUMBER OF ACTIVE SHORE-BASED LTFS AND TOTAL ANNUAL VOLUME OF LOGS TRANSFERRED TO WATER WITHIN THE AREA OF COVERAGE (2008-2012)

Year	Number of Active LTFs within the Area of Coverage	Total Annual Volume Transferred (MBF)
2008	8	90,237
2009	7	115,171
2010	9	130,786
2011	7	112,503
2012	9	117,120
Average 2008-2012	**5**	**113,163**

TABLE 2-3. VOLUME (MBF) OF LOGS STORED AT OFFSHORE LTFS (2008-2012)

(MBF represents thousands of board feet of timber)

Permit Number	Facility Name	2008 Volume Transferred (MBF)	2009 Volume Transferred (MBF)	2010 Volume Transferred (MBF)	2011 Volume Transferred (MBF)	2012 Volume Transferred (MBF)
AKG700061	Saltery Point LTF LSA	24,161	38,126	14,500	24,495	14,497
AKG701031	Hydaburg Ship Moorage	24,161	38,126	66,250	45,036	15,457
AKG701040	Wadleigh Island LSA	1,000	4,000	6,000	0	0

TABLE 2-3. NUMBER OF ACTIVE OFFSHORE LTFS AND TOTAL ANNUAL VOLUME OF LOGS STORED WITHIN THE AREA OF COVERAGE (2008-2012)

Year	Number of Active Offshore LTFs within the Area of Coverage	Total Annual Volume Stored (MBF)
2008	3	25,161
2009	3	42,126
2010	3	72,250
2011	2	45,036
2012	2	15,457
Average 2008-2012	**2.6**	**50,008**

This volume represents a portion of the volume reported in Table 2.1.

2.2 LOG TRANSFER METHODS

Timber harvest was begun in the early 1900's in southeast Alaska and the methods of transferring logs into marine waters for transport to mills have evolved over the decades. Prior to the 1930's, timber harvest was frequently accomplished by "hand loggers" who selected trees that would fall or slide into the water. Following this period, mechanized transfer methods became more common with logs being transferred via mechanized devices anchored offshore or located on land (Faris and Vaughan, 1985).

The method by which logs are transferred to the water is of interest because the transfer methods may result in differing amount of bark and wood debris loss and impacts to nearshore habitat. In general, methods that transfer logs to water with greater force have a greater potential to dislodge bark and wood debris which can accumulate in the vicinity of LTFs. Tetra Tech (1996) reviewed the literature on bark loss associated with different methods of transferring logs into marine waters. The lowest average bark loss (7.9 percent) was associated with log transfer using cranes which resulted in an average log entry speed into water of 2.7 ft/sec. The highest average bark losses (15.5 – 28.5 percent) were associated with slides, which transferred logs with an average water entry speeds ranging from 5.8 to 26.1 ft/sec. The APDES General Permit for LTF facilities in Southeast Alaska does not specify the methods by which logs can be transferred to marine waters; however, the permit does stipulates that the speed of log bundles entering receiving waters from shore-based LTFs shall not exceed 3 ft/sec and not exceed 10 ft/sec for self-dumping barges.

Tetra Tech (1996) reviewed information in U.S. EPA Region 10 permit files for LTFs in southeast Alaska and determined that information on log transfer methods were available for 69 LTFs. Slides (25 facilities), A-frames (20 facilities), direct dumping (16 facilities), and cranes (11 facilities) were the most commonly used transfer methods; several facilities used more than one transfer method. In May 2005, information on log transfer methods from ADEC Juneau office files was reviewed for 36 LTFs over the period of year 2000 through 2004 (Tetra Tech 2005). Slides (low angle ramps) were the most common transfer method employed (16 facilities) followed by A-frames (10 facilities), cranes (6 facilities), chain conveyor (2 facilities), and helicopter transfer (1 facility).

2.3 SPECIES OF LOGS TRANSFERRED

LTFs that operate under the APDES General Permit for log transfer facilities in southeast Alaska are not required to provide information on the species of trees that are transferred at these facilities. However, western hemlock, Sitka spruce, red cedar, and yellow cedar are the dominant species available for harvest in southeast Alaska (Alaska Forest Association). The tendency for logs to lose their bark during the transfer process and the composition and quantity of leachates potentially released from LTFs can vary among tree species (Kai 1991; Laks; 1991; Tetra Tech 1996). Other factors that influence the loss of bark, wood debris, and leachates from LTFs include season, nature of the wood, tree growth conditions, and the tree age (Tetra Tech 2005).

2.4 OPERATIONAL PRACTICES

LTFs that operate under the APDES General Permit for log transfer facilities in southeast Alaska are not authorized to discharge any waste streams, including spills and other unintentional or non-routine discharges of pollutants, which are not part of the normal operation of the facility, or any pollutants that are not ordinarily present in such waste streams. In addition, the APDES General Permit requires that the following best management practices (BMPs) be implemented to minimize the discharge of bark and other pollutants from the LTF.

2.4.1 Shore-Based and Off-Shore LTFs

- Log bundles shall be placed into the receiving waters at a single discharge point specified in the NOI;
- No in-water bundling of logs shall occur;
- Log rafts, logs and log bundles which have been transferred to the receiving water shall remain floating at all times and shall not be allowed to rest on or touch the bottom;
- Rafting and/or storage shall be in water at least 40 feet deep at Mean Lower Low Water (MLLW), in an area with currents strong enough to disperse wood debris;
- Logs or log bundles shall be moved out of the log raft make-up and storage areas at the earliest possible time to minimize the retention time of logs in water;
- The log transfer device shall be operated to minimize the discharge of petroleum and lubricating products into receiving waters; and
- Solid waste shall not be deposited in or adjacent to waters of the United States, including wetlands and marine tidelands. Solid waste includes cables, metal bands, used equipment, machinery, vehicle or boat parts, metal drums, appliances, and other debris.

In addition to the above BMPs, the following requirements also apply to all shore-based LTFs.

2.4.2 Shore-based LTFs

- The speed of log bundles entering receiving waters shall not exceed 3 feet per second;

- No in-water sorting of log shall occur;
- All logs deposited on the tidelands during float-off log transfer operations shall be removed on a daily basis;
- Bark and wood debris that accumulate at the log transfer device and on the adjacent tidelands shall be removed daily, to the maximum extent achievable;
- Bark and wood debris that accumulates in upland traffic flow areas shall not be allowed to enter fresh waters, wetlands, marine waters or tidelands. This debris shall be removed and disposed of on a regular basis such that the debris, or its leachate, shall not enter marine waters; and
- If continuous coverage of bark and wood debris exceeds both 1.0 acre and a thickness of 10 centimeters at any point, the operator shall submit, along with a bark monitoring survey required under the APDES General Permit, a statement describing remedial practices that will be used to minimize additional bark accumulation and shall immediately incorporate those practices in a Pollution Prevention Plan.

2.4.3 Off-Shore LTFs

- The speed of logs or log bundles entering receiving waters shall not exceed 10 feet per second for self-dumping barges and shall not exceed 3 feet per second for all other off-shore log transfer facilities;
- Log transfer shall occur in waters at least 60 feet deep at MLLW, except that log transfer may occur in waters 40-60 feet deep at MLLW if the permittee demonstrates, and DEC agrees, that no practicable alternatives are available in deeper water;
- No in-water disposal of limbs and other debris removed from logs shall occur; and
- All logs shall be limbed, to the maximum extent practicable, prior to their discharge into the receiving waters.

2.5 TYPES OF DISCHARGES FROM LTFS IN ALASKA

Several types of pollutants may be discharged into the marine environment as a result of LTF operations that comply with the BMPs listed above. The composition and quantity of the following types of discharges are considered in subsequent sections of this chapter.

- Bark and wood debris
- Leachates
- Petroleum products
- Storm water runoff
- Miscellaneous minor pollutants

2.5.1 Bark and Woody Debris

Bark and woody debris may enter marine waters during log transfer activities as a result of the abrasion of log surfaces with log transfer equipment (e.g., log slide surfaces, metal banding material), impact of logs entering receiving waters, and contact of logs within and between log bundles. The introduction of wood debris may also occur due to runoff from uplands adjacent to marine waters; however, BMPs are intended to minimize or prevent wood from upland areas entering marine waters.

2.5.1.1 Composition

Generally, the species composition of bark and woody debris discharged from a LTF reflects the species composition of the logs being transferred at the facility. Species-specific differences in bark loss have been documented (Tetra Tech 2005). Historically, the majority of the logs transferred in southeast Alaska were western hemlock and Sitka spruce, followed by red and yellow cedar (Tetra Tech 1996). Current information on the species of trees transferred at LTF facilities is not available but likely remains the same based on species composition throughout the Area of Coverage.

2.5.1.2 Quantity

The volume of bark and woody debris that enters marine waters is primarily dependent upon the amount of logs that are transferred at a site; however, other important factors include the method of transfer, and the species and condition of the trees being harvested. The persistence of the bark and woody debris in the vicinity of a LTF depends upon the factors that determine whether or not the woody debris is dispersed (local current speeds, frequency and magnitude of storm events, local substrate characteristics); the characteristics of the wood material that effect degradation rates (tree species, type of wood tissue, particle size, nutrient content); the amount and timing of wood loading (temporal activity pattern of the LTF), and characteristics of the receiving waters (e.g., dissolved oxygen concentrations, sedimentation rates).

From 1985 until April 27, 2004, the effective date of EPA modifications to the 2000 LTF GPs, NPDES permits for new LTFs required that all permittees that transferred a total of 15 mmbf or more over the life of the permit (5 years), and were located in water depths less than 60 feet at MLLW, conduct annual bark monitoring surveys to determine the areas of continuous[2] and discontinuous[3] coverage by bark and wood debris and the depth of bark and wood debris along specified transect sampling points. The 2004 modifications to the bark monitoring program required that permittees determine the depth, total area, and outer boundary of continuous cover in water depths to -100 feet and the depth, total area, and outer boundary of discontinuous cover in water depths to -60 feet.

The APDES General Permit further requires that if the monitoring survey determines that the area of continuous coverage by bark and wood debris exceeds 1.0 acre and a thickness of 10 centimeters at any point, the LTF operator must submit a statement describing the remedial practices that will

[2] Continuous coverage is defined as 100 percent bark and wood debris coverage measured within a square yard area at each transect sampling point.
[3] Discontinuous coverage is defined as 10 – 99 percent bark and wood debris coverage measured within a square yard area at each transect sampling point.

used to minimize additional bark accumulation and incorporate those practices in a Pollution Prevention Plan for the LTF.

DEC's August 24, 1999 CWA Section 401 certification of the 2000 LTF GPs included a Remediation Plan requirement "If continuous coverage by any existing bark and wood debris, whenever deposited, exceeds both 1.0 acre and a thickness of 10 centimeters at any point, the operator shall submit a proposed Remediation Plan to the Department within 120 days, unless additional time is granted by the Department." This requirement was continued in the December 5, 2008 modification to the October 10, 2008 Final Certification of NPDES Permit AKG70000 and AKG701000.

Bark monitoring survey data were available for 12 LTFs that operated for at least one year during the five year period from 2008 – 2012. The areas of continuous bark coverage for the active LTF facilities for which data were available ranged from 0.0 to 1.31 acres, with a median value of 0.12 acre. Only one facility, East Port Frederick -Long Island LTF, located near Hoonah (Map ID #4; Figure 3) exceeded the one-acre, 10 cm continuous bark coverage threshold in the General Permit Area of Coverage during the five year period from 2008-2012. Bark monitoring survey results indicate that although the area of continuous bark coverage at this facility exceeded the one-acre threshold in 2008 (1.31 acres), the area of continuous bark coverage decreased to 0.92 acres in 2009. DEC approved a Remediation Plan submitted by the permittee on March 14, 2005. On December 13, 2010 terminated the requirements of the Remediation Plan as the extent of continuous cover had naturally attenuated to less than 1.0 acres based on the June 7, 2010 bark dive survey report. The most recent bark monitoring survey results for this facility indicate that in 2012 the area of continuous bark coverage was 0.8 acres.

Historic bark monitoring survey data (either continuous bark coverage area and/or maximum bark depth) were compiled for 36 LTFs that operated for at least one year during the five year period of 2000 – 2004 (Tetra Tech 2005). These data indicate that the areas of continuous bark coverage for the 33 active LTF facilities for which data were available ranged from 0.0 to 2.1 acres, with a median value of 0.2 acres (Tetra Tech 2005). The maximum bark and wood thickness for LTFs active during the 2000-2004 period ranged from 1.3 to 121.9 cm, with a median value of 31.8 cm.

The results of bark surveys conducted during 2000-2002 were also examined for 29 LTFs that did not operate during 2000-2004 (Tetra Tech 2005). The areas of continuous bark coverage for these facilities ranged from 0.0 to 0.8 acres, with a median value of 0.1 acres; the total continuous bark coverage for all 29 inactive LTFs reviewed for the 2005 study was 6.2 acres. The maximum bark and wood thickness for inactive LTFs ranged from 1.3 to 101.6 cm, with a median value of 38.1 cm (Tetra Tech 2005).

2.5.2 Leachates

Soluble organic compounds, referred to as leachates, are released by logs stored in water and submerged bark deposits. Leachates in marine waters in southeast Alaska could potentially occur due to: 1) leaching from bark and wood debris present in receiving waters; 2) leaching from log rafts; and 3) transport of leachates in runoff from LTFs. Sources of leachate runoff include materials from bark and wood debris present in sort yards during rainfall events (Tetra Tech 2005).

The character of wood leachates varies for different tree species and may also depend on factors such as season, the type of wood tissue (i.e., sapwood versus heartwood), tree growth conditions, and the tree age (Kai 1991; Laks 1991; Sedell and Duval 1985). Seasonal changes in productivity and environmental stress may influence the relative quantities of organic compounds in a tree, especially in the sapwood (Tetra Tech 2005). The type of wood tissue exposed to water can also influence the character of the leachates released; for example, heartwood material is likely to have a greater concentration of extractable compounds than sapwood material (Tetra Tech 1996). Tree growth conditions and tree age are also reported to result in qualitative and/or quantitative changes in the chemicals present, with older trees generally having higher percentages of chemical extracts (Tetra Tech 1996).

2.5.2.1 Composition

The types of compounds in wood leachates include tannins, resins, oils, fats, terpenes, flavonoids, quinines, carbohydrates, glycosides, and alkaloids (Sedell et al. 1991). The tannin, flavonoid, resin, and quinine components are the constituents primarily responsible for the yellow to brown color associated with leachates.

2.5.2.2 Quantity

The rate of leaching varies with a number of factors including the flushing rate, species and age of wood, time the wood or bark has been in the water, and temperature (Atkinson 1971). In addition, leaching of organic compounds from wood is reported to be faster in saltwater than in freshwater (Sedell and Duval 1985). Although in-place leaching rates may be quite variable, tree species may be ranked according to their leaching rates (from highest to lowest) as follows: western red cedar (*Thuja plicata*), Alaska cedar (*Chamaecyparis nootkatensis*), western hemlock (*Tsuga heterophylla*), and Sitka spruce (*Picea sitchensis*) (Peace 1974).

Based on a recent review of the scientific literature, it does not appear that any direct measurements of leachate concentrations have been reported for marine waters near LTFs in Southeast Alaska. Total leachate release of approximately 18 kg leachates per cubic meter of bark and woody debris has been estimated based on assumptions about the discharge of bark and wood from LTF facilities, wood density, weight percentage of leachate extracts in wood and bark, and the percentage of total leachate extract that is released to marine waters (Tetra Tech 1996). Using reported measurements of leachate rates, and assuming a constant rate of leaching, it was estimated that it would take at least 2.5 years for the total mass of leachate at the site to be released to marine waters (Tetra Tech 2005).

2.5.3 Petroleum Products

Petroleum products may be introduced into the marine environment through unintentional spills of fuels or lubricants, boat operations, runoff from sort yards, or log transfer operations where waters are exposed to oils and greases on machinery or on logs that have been in contact with machinery.

The APDES General Permits for LTFs in Southeast Alaska require oil sheen monitoring and reporting to be conducted. Discharges of petroleum hydrocarbons, oil and grease are not permitted under the general APDES permit.

2.5.3.1 Composition

While the specific composition of petroleum products released into marine waters due to LTF operations is unknown, it is likely that the petroleum products consist of greases, oils, hydraulic fluids, and fuels. Information provided in annual monitoring reports indicate that the sources of sheens reported at LTFs in Southeast Alaska include: accidental spills of hydraulic fluid, fuel oil, lube oil, engine oil, gear oil, diesel, and unspecified fuel.

2.5.3.2 Quantity

Estimates of the quantities of petroleum products discharged into marine waters obtained from Annual Reports for oil sheen occurrences, ranged from small amounts recorded as "one cup" or "small" to a maximum of 425 gallons (1,609 liters) of fuel oil associated with the sinking of a vessel (Tetra Tech 2005). The annual monitoring reports provide volume estimates of spills for the majority of individual spill events. Based on monitoring reports for the thirteen year period from 2000-2012, the total volume of petroleum product spilled was approximately 650 gallons (2,461 liters); however, 87 percent of this volume was associated with a single boating accident which occurred on December 9, 2000 near the East Port Frederick LTF (Tetra Tech 2005). Based on the frequency of occurrence and magnitude of spills, it appears that relatively small and infrequent amounts of petroleum products enter marine waters in association with LTF operations (Tetra Tech 2005). None of the active LTFs for the period 2008 to 2012 reported a visible sheen on their annual reports.

2.5.4 Storm Water Runoff

No information is currently available on storm water discharges from LTFs. Southeast Alaska receives substantial amounts of precipitation. In 2012, annual precipitation totaled 63.42 inches (161 cm) in Juneau, slightly above the annual average of 62.27 inches (158 cm) for the period from 1981- 2010 (National Weather Service 2013). Based on measured precipitation rates in the Area of Coverage, it is likely that some storm water runoff is occurring. However, based on available data, it is not possible to estimate the composition or quantity of storm water entering marine waters in conjunction with LTF operations.

2.5.5 Miscellaneous Minor Pollutants

Miscellaneous minor pollutants, including solid and liquid wastes, could potentially be introduced to marine waters near LTFs in Southeast Alaska. However, BMPs specified in the APDEC General Permit for southeast Alaska LTFs specify that "solid waste shall not be deposited in or adjacent to waters of the United States, including wetlands and marine tidelands. Solid waste includes cables, metal bands, used equipment, machinery, vehicle or boat parts, metal drums, appliances, and other debris."

2.5.5.1 Composition

A variety of miscellaneous pollutants could potentially be discharges from the LTFs. Solid wastes may include wire rope, metal banding material, and other materials associated with log transfer activities.

2.5.5.2 Quantity

The quantity of miscellaneous minor pollutants is unknown, but is likely to be small in comparison with the quantity of other pollutants discharged. Transfer methods are unlikely to affect the quantity of minor pollutants discharged.

2.6 SUMMARY

The pollutants of concern potentially discharged from LTFs in Southeast Alaska include bark and woody debris, leachates, petroleum products, storm water discharge, and miscellaneous minor pollutants. The compositions and quantities of discharges are dependent upon the quantity and species of logs transferred, transfer type, and operating practices.

Twenty-one LTFs were active during at least one year during the five year period from 2008 through 2012, with only three shore-based facilities actively transferring logs during all five years. The number of individual shore-based facilities actively transferring logs during any given year ranged from seven to nine during the five year period from 2008 through 2012 (Table 2-2). The maximum volume of logs transferred in any given year was 212 mmbf in 2010. This value represents the sum of the volumes reported for all facilities in 2010. The annual average volume of logs transferred to water at individual LTFs during the five year period from 2008 through 2012 ranged from 0.04 to 44.8 mmbf. The total volume of logs transferred over the five year period (2008-2012) at individual shore-based LTFs ranged from 0.2 to 224.1 mmbf, with nine facilities transferring total log volumes greater than 15 mmbf.

Bark and woody debris are one of the main discharges associated with LTFs. Bark monitoring survey data were available for 12 LTFs that operated for at least one year during the five year period from 2008 – 2012. The areas of continuous bark coverage for the active LTF facilities for which data were available ranged from 0.0 to 1.31 acres, with a median value of 0.12 acre. Only one facility exceeded the one-acre, 10 cm continuous bark coverage threshold in the General Permit Area of Coverage during the 5 year period from 2008-2012. Bark monitoring survey results indicate that although the area of continuous bark coverage at that facility exceeded the one-acre threshold in 2008 (1.31 acres), the area of continuous bark coverage decreased to 0.92 acres in 2009. The most recent bark monitoring survey results for that facility indicate that the area of continuous bark coverage was 0.8 acres in 2012.

Soluble organic compounds, referred to as leachates, are released by logs stored in water and submerged bark deposits. Leachates in marine waters in Southeast Alaska could potentially occur due to leaching from bark and wood debris present in receiving waters, leaching from log rafts, and transport of leachates in runoff from LTFs. Estimation of the quantity and composition of leachates entering marine waters as a result of LTFs operations is problematic, and no recent monitoring of this discharge has occurred.

LTF facilities are required to monitor for the presence of oil sheens. Information provided in annual monitoring reports indicates that the sources of sheens reported at LTFs in Southeast Alaska include: accidental spills of hydraulic fluid, fuel oil, lube oil, engine oil, gear oil, diesel, and unspecified fuel. Based on monitoring reports for the thirteen year period from 2000-2012, the total volume of petroleum product spilled was approximately 650 gallons (2,461 liters); however, 87 percent of this volume was associated with a single boating accident. None of the active LTFs (2008 to 2012) reported a visible sheen on their annual reports. Based on the frequency and magnitude of reported spills, it appears that relatively small and infrequent amounts of petroleum products may enter marine waters in association with LTF operations.

Based on measured precipitation rates in the Area of Coverage, it is likely that some storm water runoff is occurring. However, based on available data, it is not possible to estimate the composition or quantity of storm water entering marine waters in conjunction with LTF operations. The low incidence of reported oil sheens for active facilities, and the BMPs specified in the general NPDES permit, may suggest that LTFs in southeast Alaska do not discharge large quantities of pollutants via storm water runoff.

Miscellaneous minor pollutants, including solid and liquid wastes, could potentially be introduced to the marine waters near LTFs in southeast Alaska. However, BMPs specified in the APDES General Permit for southeast Alaska LTFs specify that "solid waste shall not be deposited in or adjacent to waters of the United States, including wetlands and marine tidelands."

No data are available on the quantities or composition of minor pollutants entering marine waters near LTFs.

3.0 TRANSPORT, PERSISTENCE, AND FATE OF MATERIALS DISCHARGED

In order to accurately assess potential impacts to the marine environment in the Area of Coverage due to operation of LTFs, it is necessary to consider the transport, persistence, and fate of pollutants discharged. The transport of a pollutant depends on its specific physical and chemical characteristics and the physical transport processes operating in the receiving waters (e.g., tidal currents, wind driven currents, freshwater inflow, and storm frequency and intensity). Pollutant persistence is a function of the degradation rate of a pollutant, the transport processes, and the cycling of the pollutant between sediments, water, and biota. The fate of pollutants discharged from LTFs in southeast Alaska involves the life cycle of the pollutants after their release, and determines the effects of the pollutants during periods of transport and persistence.

The transport, persistence, and fate of the categories of pollutants described in Chapter 2 (bark and woody debris, leachates, petroleum products, storm water, and miscellaneous minor pollutants) are discussed in the remainder of this section.

3.1 TRANSPORT

3.1.1 Bark and Woody Debris

The transport of bark and woody debris that enter marine waters during log transfer operations is dependent upon multiple variables, most of which are site-specific and include:

- Volume of logs transferred
- Methods used for log transfer
- Species composition and age/condition of logs transferred
- Size distribution of bark and wood particles discharged
- Size-specific sinking rates of bark and wood particles
- Depth and volume of the receiving water
- Tidal and wind-driven current speeds and directions in the vicinity of discharges
- Frequency, intensity, and general effects of storm events on transport processes.

The variables listed above determine whether bark and woody debris accumulate in the vicinity of LTF operations or are dispersed away from the transfer site. The above variables may be divided into two main categories: 1) physical/ meteorological factors that affect local current speeds and the characteristics of local storm events, and 2) wood characteristics that influence the sinking rates of bark and woody debris.

Currents and storm events are the principal mechanisms by which wood particles can be dispersed away from LTF sites. Effective dispersal would occur if an LTF was located such that:

1. strong, outward flowing bottom currents occurred during each tidal cycle;
2. surface currents are of sufficient magnitude to transport wood particles and net flow is away the LTF site; and

3. storm events result in a net transport of wood particles away from LTF activities.

The sinking rate of wood particles has not been extensively studied; however, it is known that a number of variables including the tree species, type of wood tissue, wood condition, particle size, wood density, and particle shape can all influence the sinking rate of wood particles (Tetra Tech 2005). Ott Water Engineers (1984) measured average sinking rates of four size classes of ponderosa pine bark ranging from 0.5 to 4.0 cm (0.2 to 1.6 in). Sinking rates increased with particle size and ranged from 0.042 to 0.067 m/sec (0.14 to 0.22 ft/sec).

Annual bark monitoring surveys currently conducted at LTF sites are not specifically designed to measure the transport of bark and wood particles; however, they do provide a measure of the accumulation of these materials in the vicinity of LTF operations. The surveys measure the thickness and area of continuous bark and woody debris cover occurring in water depths up to 100 feet MLLW, and the area of discontinuous and trace cover bark and woody debris in water depths up to 60 feet MLLW. As described in section 2.5.2, continuous bark coverage monitored at active LTFs during the period from 2008 to 2012 ranged from 0.0 to 1.31 acres, with a median value of 0.2 acres.

3.1.2 Leachates

Leachates are soluble organic compounds released by logs stored in water and submerged bark deposits. In addition to water-soluble polysaccharides and tannins, wood waste leachate or degradation can result in the presence of compounds such as phenols, methylated phenols, benzoic acid, benzyl alcohol, terpense and tropolones (Kendall and Michelsen 1997). The transport of these compounds is dependent upon the rate at which they are released to surrounding waters, and upon local water movements, principally tidal and wind-driven currents that dilute and disperse the compounds. Transport of leachates is complicated by the tendancy of the leachates to precipitate in seawater (Pease 1974; Schaumburg 1973; Tetra Tech 2005). In general, transport conditions that would effectively disperse bark and woody debris (i.e., outward flowing currents, net outward transport of materials during storm events, and short flushing times) are expected to effectively disperse and dilute leachates introduced into the marine environment.

3.1.3 Petroleum Products

The transport of petroleum products accidentally released during spill events or discharged as a result of LTF operations has not been rigorously documented. Current APDES permit requirements for LTFs require that the presence of oil sheens be reported; however, information regarding the dimensions of the sheen or the distance that petroleum products are transported is not documented. None of the LTFs examined have conducted studies assessing the transport of petroleum products. Therefore, the chemical properties of the components of petroleum that could influence the transport potential of released petroleum is discussed. Petroleum is comprised of a variety of compounds that can loosely be categorized as volatiles (benzene, toluene, ethylbenzene and xylenes [BTEX]), high molecular weight (HMW) and low molecular weight (HMW) polycyclic aromatic hydrocarbons (PAHs), and long-chain hydrocarbons.

Upon release to marine waters, BTEX are expected to volatilize and readily biodegrade. LMW PAHs tend to demonstrate slightly more mobility than HMW PAHs, more solubility, and are more subject to degradation, indicating a higher propensity to disperse (Eisler, 1987). HMW PAHs are more readily biodegradable in surface water than in sediment. However, because of their highly organic nature, the low dipole moment of their molecular structures, and large molecular sizes, HMW PAH compounds are more likely to settle and be adsorbed onto sediment due to their strong affinity for organically enriched substrates. Once sorbed to sediment, HMW PAHs have low water solubilities and are relatively resistant to leaching from sediments. In general, the transport properties of the long-chain hydrocarbons will be similar to HMW PAHs, Therefore, the primary transport potential for HMW PAHs and long-chain hydrocarbons in sediment is re-suspension of sediments with currents.

3.1.4 Storm Water Runoff

As noted in Section 2.5, no information is available on storm water discharges from LTFs in southeast Alaska. Transport of pollutants contained in storm water discharges would be expected to be driven by the local physical and meteorological factors that determine local water movements and net vectors of water transport away from discharge locations.

3.1.5 Miscellaneous Minor Pollutants

The extent to which miscellaneous minor pollutants are transported will depend greatly on the nature of the pollutant. Solid wastes will be transported to varying degrees depending upon the physical characteristics of the waste and the magnitude of local currents and storm events. The transport of liquid wastes will also depend on the magnitude and direction of local water movement, but these wastes will also be diluted by receiving waters.

3.2 PERSISTENCE

The persistence of discharged materials in the vicinity of LTFs in southeast Alaska is determined by the net transport of materials away from the site and the degradation rates of material that is not transported out of the area.

3.2.1 Bark and Woody Debris

The persistence of bark and woody debris in the vicinity of a given LTF is likely affected by the species and chemical characteristics of trees being transferred, local sedimentation rates, oxygen concentrations and water temperature in the vicinity of wood deposits, the geophysical characteristics of the site, the size distribution of wood particles, and the carbon:nitrogen ratio of the wood particles, which influences rates of degradation by biological processes.

Monitoring of bark and woody debris in the vicinity of inactive LTFs indicate that these deposits can be extremely long-lived. Extensive accumulations of bark and woody debris have been found at LTFs in southeast Alaska more than a decade following the cessation of operations (e.g., Schultz and Berg 1976). However, the authors investigated 32 facilities and reported that divers found no bark at thirteen of the facilities.

Decay rates of 0.011/yr and 0.0135/yr have been reported for Sitka spruce and western hemlock, respectively (Harmon et al. 1986). These decay rates suggest that the amount of time required for 90 percent of the wood material to decay would be 209 and 171 years, respectively (Tetra Tech 2005).

3.2.2 Leachates

The persistence of leachates is likely to be variable given the large number of individual compounds that comprise this discharge category. The water-soluble polysaccharides (e.g., carbohydrates and glycosides) may provide a good substrate for microbial growth leading to rapid degradation by biological processes. Likewise, biodegradation is an important fate process that limits persistence of benzoic acid and phenol (Howard 1989). The tannins, and other more refractory compounds, are likely to persist for longer periods of time. Quantitative estimates of the persistence of leachates in the marine environment are not available. Some authors have noted the tendency for leachates to precipitate in marine waters subsequent to reaction with the chloride ions found naturally in seawater (Sedell and Duval 1985). The dissolved components of leachates would be expected to be transported by local water currents. Precipitated leachates may have a greater potential for remaining in the vicinity of LTFs, particularly if the precipitates adhere to bottom substrate.

3.2.3 Petroleum Products

The persistence of a petroleum product in the marine environment depends upon the properties and composition of the petroleum product. Volatile fractions of petroleum products may evaporate into the atmosphere over a relatively short period of time (~days), while water-soluble fractions may undergo chemical transformations in the water column. Photochemical oxidation processes may increase the bioavailability and toxicity of certain petroleum compounds discharged to seawater (Patin 2005). The final products of oxidation usually have increased water solubility. Some components of the petroleum product may be adsorbed onto particles suspended in the water column, and may be subsequently deposited to bottom sediments. The rates of such sedimentation processes may depend upon the composition of the petroleum product, the concentrations and composition of suspended sediment particles, water depth, and energy environment of the receiving waters. The adsorbed petroleum may also be consumed or absorbed by plankton and other organisms which can hasten the sedimentation process by concentrating the material in faster-sinking fecal pellets. Once the petroleum product reaches the seafloor and becomes buried by bioturbation and/or sedimentation, the decomposition rate decreases substantially, especially under anaerobic conditions. Heavy fractions of petroleum products may take months to years to degrade under these conditions (Patin 2005). Microbial transformation and degradation of petroleum substances released to marine waters is the ultimate fate of most, if not all, released compounds. In addition, for certain components of petroleum such as PAHs, bioconcentration and bioaccumulation may be an important fate process contributing to persistence. Bioaccumulation potential of PAHs is influenced by a variety of factors including animal behavior and physiology (e.g., feeding type, diet composition, and ability to metabolize PAHs), the physical/chemical properties of the PAHs (solubility, octanol-water partitioning, etc.), and sources and physical/chemical properties of the receiving environment (e.g., total organic carbon, dissolved organic content of water column, microbial degradation, etc.) (McElroy et al., 1990). LMW PAHs, which are more water soluble, are rapidly accumulated, however, bioconcentration and bioaccumulation is generally not significant for most species since most organisms can metabolize PAHs. However, algae, mollusks and other invertebrates metabolize PAHs much more slowly and are more likely to accumulate PAHs (Eisler, 1987). Bioaccumulation factors (BAFs) tend to be low (less than one) for most sediment-dwelling organisms. BAFs of 0.1 to 11 in benthic marine invertebrates have been reported (Neff and

Breteler 1983). However, in another study, BAFs of PAHs from sediment to invertebrates (clams and clam worms) of 0.2 to 4 were reported (Foster and Wright 1988). The degree and rates of degradation of the long-chain hydrocarbon components of petroleum compounds depends upon their molecular structure. For example, paraffin compounds (alkanes) biodegrade faster than aromatic and napthenic structures (Patin 2005).

The persistence of individual petroleum compounds, and their degradation products, implies that these compounds may persist in the marine environment for time spans ranging from hours to years depending upon their properties and subsequent transformations. Given that the specific petroleum products used at LTFs are not well characterized, and the persistence of any discharges in the vicinity of a LTF is highly dependent upon local transport processes, it is not possible to calculate accurate estimates of the persistence of petroleum compounds discharged from LTF facilities.

3.2.4 Miscellaneous Minor Pollutants

The persistence of miscellaneous minor pollutants is likely to be specific to the pollutant that is discharged.

3.3 FATE AND EFFECTS

The fate of discharged materials is dependent on local transport processes and the degree to which the material is persistent in the environment. The potential fate and possible environmental effects for each category of potential discharges is discussed below.

3.3.1 Bark and Woody Debris

Bark and woody debris can affect water and sediment quality during transport and subsequent degradation. Potential impacts to the marine environment due to bark and woody debris include the following:

- Changes is sediment grain size and labile organic matter content
- Reductions in oxygen levels of sediments and overlying waters
- Release of leachates
- Direct impact to organisms present in receiving waters and sediments.

The effects of deposits of bark and woody debris on sediment characteristics and organisms are discussed briefly in this section and in greater detail in Chapter 5.0. Briefly, the impacts of bark and woody debris on sediment characteristics may include alteration of the substrate (grain size, labile organic matter content) to the extent that it is no longer a suitable habitat for the original, non-impacted sediment-dwelling community (Tetra Tech 2005). Because of the potential persistence of bark and woody debris, substrate alteration may affect the benthic community for substantial periods of time after the cessation of LTF operations. In addition to the potential habitat loss caused by substrate alteration, benthic organisms may also be directly impacted by burial under bark and woody debris. Other potential impacts associated with bark and woody debris may result from release of leachates and potential reductions in dissolved oxygen.

3.3.2 Leachates

The release of leachates may potentially affect water quality in the vicinity of LTFs by imparting a yellow-brown coloration to waters (e.g., Schaumburg 1973), contributing to increased oxygen demand (e.g., Sprout and Sharp 1968; Sedell and Duval 1985), decreased pH (e.g., Pease 1974), as well as having the potential to have toxic effects on some organisms (e.g., Buchanan et al. 1976). The potential for leachate toxicity to organisms is addressed in Section 5; the potential for water quality impacts to dissolved oxygen, pH, and coloration are addressed in Section 9.

3.3.3 Petroleum Products

The discharge of petroleum products, which are known to be toxic to organisms at low concentrations (see Chapter 5.0), into marine waters in southeast Alaska have the potential to degrade water quality depending upon the magnitude and frequency of discharges, and the composition of the discharged products. The development of sheens is another environmental concern (see Section 5.3). Based on oil sheen monitoring reports provided over the thirteen year period from 2000 through 2012, oil discharges from LTFs appear to occur infrequently (see Section 2.4.1) and, with the exception of one boating accident (see Section 2.4.2), release small quantities of petroleum to marine waters. Under normal operating conditions, it is unlikely that large quantities of petroleum products would be released to the marine environment as a result of LTF operations. The greatest potential for release of petroleum products may be for LTFs using chain conveyors to transfer logs to marine waters. Based on the review of active LTFs in southeast Alaska, only two facilities appear to be using this transfer method (see Table 2-2).

3.3.4 Miscellaneous Minor Pollutants

The fate of miscellaneous minor pollutants is difficult to assess given the uncertainty in the composition of these pollutants. For degradable pollutants there may be small localized oxygen depressions. More recalcitrant pollutants may not exert any noticeable oxygen demand. The release of toxic compounds may be possible from some miscellaneous minor pollutants (e.g., batteries). However, it should be noted that BMPs in the general NPDES for LTFs prohibits the discharge of solid wastes (cables, metal bands, used equipment, machinery, vehicle or boat parts, metal drums, appliances, and other debris).

3.4 SUMMARY

The transport, persistence, and fate of potential pollutants likely to be discharged from LTFs are dependent upon the magnitude of the discharges, the characteristics of the pollutants, and the local physical and meteorological conditions in the vicinity of LTFs that affect the dispersal and accumulation of pollutants.

Dispersal and dilution of pollutants that enter the marine environment from LTFs is likely to minimize most adverse impacts. Effective dispersal will occur if an LTF is located such that strong, outward-flowing bottom currents occur during each tidal cycle; surface currents due to tides and winds case a net transport of pollutants away from the LTF site; storm events of sufficient magnitude and frequency transport and disperse pollutants away from the site; and the flushing of receiving waters occurs over a relatively short period of time (several days).

Transport processes necessary to disperse and dilute pollutants discharged from LTFs are difficult to characterize because of the heterogeneity of the discharges and the variability of the local environment of individual LTFs that affect fate and transport processes.

The persistence of potential pollutants discharged from LTFs is likely to be highly variable, with bark and woody debris being of particular concern given their abundance and persistence, which may span several decades.

4.0 COMPOSITION OF BIOLOGICAL COMMUNITIES

The determination of "unreasonable degradation" of the marine environment is to be based upon consideration of the ten criteria listed in Chapter 1. The following chapter provides information pertinent to consideration of the two ocean discharge criteria listed below:

- **Criterion 3:** "The composition and vulnerability of the biological communities which may be exposed to such pollutants, including the presence of unique species, the presence of those species identified as endangered or threatened pursuant to the Endangered Species Act, or the presence of those species critical to the structure or function of the ecosystem, such as these important for the food chain"
- **Criterion 4:** "The importance of the receiving water area to the surrounding biological community, including the presence of spawning sites, nursery/forage areas, migratory pathways, or areas necessary for other functions or critical stages in the life cycle of an organism"

This chapter is intended to provide an overview of the biological communities inhabiting the coastal waters of Southeast and Southcentral Alaska. Planktonic organisms, benthic organisms, fish and shellfish resources, marine birds, and marine mammals are considered. A number of species or distinct population segments (DPS) of fish, birds, and marine mammals that occur in the Area of Coverage are listed or are candidates for listing as threatened or endangered under the Endangered Species Act (ESA) of 1973. These species and DPSs are discussed in Chapter 6 and therefore are not considered in this chapter.

4.1 PLANKTONIC ORGANISMS

Planktonic organisms have limited or no ability for self-propulsion and generally are entrained along with water movements. Plankton are a diverse assemblage of plants and animals that range from a maximum size (equivalent spherical diameter) of a few millimeters (megaplankton) to less than 2 microns (μm) (ultrananoplankton) (Parsons et al. 1977). While the distribution of plankton can be very patchy both with water depth and horizontally within the water column, the list of planktonic species is not expected to change markedly between locations within the Area of Coverage.

4.1.1 Phytoplankton

Phytoplankton represent the photoautotrophic, or "plant," constituents of the plankton. In Southeast and Southcentral Alaskan waters, as in the other temperate and high latitude regions of the North Pacific, the phytoplankton community is dominated by diatom species (Semina and Tarkhova 1972). Most species are unicellular, but some species form loose colonial associations or chains (Raymont 1980). Samples collected in Chatham Strait, at stations inside and outside of Rowan Bay, showed the dominant phytoplankton species were *Skeletonema costatum, Chaetoceros debilis* and *C. decipiens* (Knull and Wing 1972).

4.1.2 Zooplankton

Zooplankton are the heterotrophic, or "animal," constituents of the plankton. The community in Southeast and Southcentral Alaska includes euphausiids, copepods, mollusc larvae, polychaete larvae, barnacle larvae, shrimp zoeae, amphipods, larvaceans, cnidarians, ctenophores, and chaetognaths. A total of 66 taxa were recovered during past sampling events in Southeast Alaska in Rowan Bay (Knull and Wing 1972). More recent sampling efforts within Icy Strait and Chatham Strait recorded zooplankton biomass in 20-m vertical hauls ranging from 2 to 9.5 mL (settled volumes) (Orsi et al. 2003).

4.2 BENTHIC ORGANISMS

Benthic organisms are those that live on, in, or near the seabed.

4.2.1 Epibenthic Algae

Epibenthic algae are photosynthetic organisms on the sea bottom and may range in size from single celled diatoms to large seaweeds (e.g., kelp). Surveys conducted by Meyers (1977) in Chatham Strait identified epibenthic algae residing in the intertidal zone, subtidal zone, and deeper waters. Intertidal algae included *Fucus distichus, Ulva lactuca,* and *Phyllospadix scouleri*, with *F. distichus* being the most abundant epibenthic algae. The subtidal zone in Chatham Strait supported 14 macroalgal taxa including species of red, brown, and green algae. The most dominant species were brown algae *Laminaria* sp. and *Agarum cribrosum.* Other species identified in nearshore waters included the encrusting coralline alga, *Lithothamnion* sp., as well as *Laminaria groenlandica*, *Fucus* distichus, and *Nereocystis luetkeana*. Abundance estimates of the algae were not given (Meyers 1977).

Information from LTF dive reports provided in Tetra Tech (1996) indicate that epibenthic algae near a Frederick Sound LTF were described as “rockweed, sea lettuce, kelp, and bull kelp.” These descriptions may refer to populations of *Fucus* sp., *Ulva* sp., *Laminaria* sp. and *Nereocystis* sp. A dive survey report near a LTF in Prince William Sound documented the presence of “rockweed”, “eelgrass”, and “sea colander”. These descriptions may refer to *Fucus distichus*., *Phyllospadix* sp. or *Zostera marina*, and *Agarum* sp.

4.2.2 Benthic Infauna

Benthic infauna are organisms that live within the bottom sediments, rather than on the sediment surface. Benthic infaunal assemblages vary greatly in species composition primarily based on the substrate type and whether the habitat is intertidal or subtidal. Benthic infauna species identified near LTFs in Southeast Alaska have been summarized by Tetra Tech (1996). Benthic grab samples from the Chatham Strait identified polychaete species from 26 families. The most abundant of the polychaetes recovered was *Nephtys cornuta*. Suction dredge samples from Chatham Strait identified 11 mollusc taxa, 18 polychaete taxa, four holothuroid taxa, one each of brachiopod, echiuroid, sipunculid, and nemertean worms. The most dominant numerical taxa was a polychaete worm (*Owenia fusiformis*). The major contributor to community biomass was the horse mussel (*Modiolus modiolus*). Other abundant taxa included: Venus clam (*Humularia kennerleyi*), bluntnose clam (*Mya truncate*), butter clam (*Saxidomus giganteus*), and polychaete worms (*Mesochaetopterus* sp. and *Euclymene* sp.).

4.2.3 Benthic Epifauna

Benthic epifauna are organisms that, for the most part, reside on the surface of bottom sediments or other substrates. These benthic epifaunal assemblages also vary in species composition according to substrate type and tidal elevation. Benthic epifauna species identified near LTFs in

Southeast Alaska have been summarized by Tetra Tech (1996). Benthic epifauna identified within Chatham Strait included 79 taxa from 11 phyla. Abundance estimates were not available, but taxa present included anemones (*Metridium senile*), tubeworms (*Serpula vermicularis*), brachiopods (*Terebratalia transversa*), sea stars (*Pycnopodia helianthoides* and *Solaster stimpsoni*), sea cucumbers (*Parastichopus californicus*), chitons (*Cryptochiton stelleri*), nudibranchs (*Melibe leonine*), snails (*Polinices pallida*), limpets (*Puncturella cucullta*), barnacles (*Balanus cariosus*), shrimp (*Pandalus danae*), and sea squirts (*Corella inflate*).

In the intertidal region of the Chatham Strait, the epifaunal community was dominated by snails (*Littorina* spp.). Other abundant species included blue mussels (*Mytilus trosullus*), barnacles (*Balanus* spp.), and limpets (*Acmea* spp. and *Notoacmea* spp.). Subtidal epifauna included 48 taxa including cnidarians, echinoderms, brachiopods, polychaetes, crustaceans, and molluscs. Taxa present included sea anemone (*Metridium senile*), tubeworm (*Serpula vermicularia*), chiton (*Tonicella lineate*), limpet (*Notoacmaea scutum*), hairy triton (*Fusitriton oregonensis*), nudibranch (*Archidoris montereyensis*), brachiopod (*Terebravalia transversa*), barnacle (*Balanus glandulus*), dock shrimp (*Pandalus danae*), sea cucumber (*Cucumaria miniata*), green sea urchin (*Strogylocentrotus droebachiensis*) and sea stars.

4.3 FISH AND SHELLFISH RESOURCES

Monitoring surveys of fish and shellfish resources near LTFs in the Area of Coverage are not required under the general APDES permit. Thus, recent data on these resources in the immediate vicinity of LTFs is not available.

4.3.1 Fish

Fish assemblages are dominated by demersal species, with walleye pollock (*Gadus chalcogrammus*), Pacific cod (*G. macrocephalus*), and arrowtooth flounder (*Atheresthes stomias*) being the most abundant species in Alaskan waters (NMFS 2005). Anadromous fish including Chinook (*Oncorhynchus tshawytscha*), coho (*O. kisutch*), sockeye (*O. nerka*), chum (*O. keta*), and pink (*O. gorbuscha*) salmon are important commercial fish in terms of harvest volume and value. Other fish of commercial value include yellowfin sole (*Limanda aspera*), sablefish (*Anoplopoma fimbria*), Pacific halibut (*Hippoglossus stenolepis*), and Pacific herring (*Clupea pallasii*). Halibut, salmon, steelhead (*Oncorhynchus mykiss*), searun cutthroat (*O. clarki clarki*) and Dolly Varden (*Salvelinus malma*) are popular sport fish.

The following discussion is divided into commercially harvested fish, such as Pacific salmon and halibut, and other species that are not commercially harvested. Many of the species that are not commercially harvested (e.g., sandlance, capelin) are important as prey for higher trophic levels.

4.3.1.1 Commercially Harvested Fish

Five anadromous species (pink, sockeye, chum, coho, and Chinook salmon), three groundfish species (Pacific cod, sablefish, walleye pollock), and one pelagic species (Pacific herring) constitute the bulk of the fish harvested commercially. A brief description of each of these species is provided below.

Pacific salmon is the major pelagic finfish group of the Alaska region. All Pacific salmon are anadromous, returning to freshwater from the ocean to spawn and then die. Most salmon rear in the North Pacific Ocean. Pacific salmon may migrate over long distances during the course of their maturation before returning to their natal spawning areas. Alaskan salmon remain in the ocean for one to four years before returning to spawn.

Pink salmon. Pink salmon spawn annually with substantially larger returns in even-numbered years. Spawning fish migrate to their natal streams in early summer and runs may continue into early August. Fry emerge from the stream gravel in spring and school in estuarine waters for approximately a month before beginning a gradual, irregular movement to the ocean where they usually remain for two years. In late summer and early fall, the large schools move off-shore to deeper waters while still remaining relatively close to shore until December when they move further off-shore. Copepods, amphipods, tunicates, and euphausiids are the dominate prey of pink salmon.

Sockeye salmon. Sockeye salmon spend two to three years in the ocean before migrating to their natal streams to spawn from early June until late August. Young sockeye remain in coastal waters during their first year of life. Juveniles feed on copepods, fish eggs and larvae, and shrimp larvae. Adult sockeye salmon prey consists of copepods, amphipods, tunicates, and euphausiids.

Chum salmon. Chum salmon remain in the ocean for three to five years before migrating to their natal streams. They spawn from late July to late October. The fry spend several months in estuarine waters before beginning their offshore migration in early fall. Juveniles feed on zooplankton (primarily copepods) and aquatic insects while adults feed on zooplankton, small fish, and squid larvae (NMFS 2005).

Coho salmon. Coho salmon spend one to two years in the ocean before migrating to their natal streams from late July to December. Young coho enter the ocean after one to four winters in freshwater and remain near-shore and near the surface where they feed on small fish and zooplankton crustaceans before moving further off-shore. Adult coho feed on squid, euphausiids, and small fish in the open ocean (NMFS 2005).

Chinook salmon. Chinook salmon spawn from mid-May to early August. Young Chinook enter the ocean after spending one to two years in freshwater and remain near-shore for a short period before moving further off-shore. Juvenile Chinook feed primarily on fish larvae and aquatic insects whereas adults feed on herring, sandlance, squid, and crustaceans.

Pacific cod. Pacific cod is a benthic species that ranges throughout the North Pacific Ocean and eastern Bering Sea. Spawning occurs during winter and the eggs are demersal. Larval cod range from pelagic to benthic waters and they grow rapidly, reaching about 3 feet in length within 2 to 3 years. Adult cod feed on a variety of worms, crabs, mollusks, shrimps, and herring.

Sablefish. The sablefish or black cod is found in large numbers in the Gulf of Alaska. Sablefish occur in deeper waters (1,200-3,000 ft [370-400 m]) where they prey on a variety of crustaceans, worms, and small fishes. The species spawns in winter and the eggs are pelagic with the larval stage occurring near the surface. Juveniles are sometimes found in large schools in near-shore waters. Sablefish migrate extensively over long distances, but without apparent timing or routing.

Walleye pollock. Walleye pollock constitute an important part of the commercial harvest in the Gulf of Alaska. This semidemersal species is found in large schools. Annual spawning begins in early spring and may continue into early summer. Pollock migrate seasonally, moving from deeper waters in the winter to more shallow water in the summer. Pollock feed on numerous species including mysids, euphausiids, and small fish. In addition to being of great commercial value, pollock serves as food for other marine fishes, birds, and mammals (NMFS 2005).

Pacific herring. Herring sac-roe is of high commercial value while adult herring are currently used mainly for bait in other fisheries. The Pacific herring populations in Alaska are generally on a downward trend. Pacific herring undergo annual spring migrations from pelagic waters to the coastal areas of Southwest Alaska, lower Cook Inlet, Prince William Sound, and the islands and coast of Southeast Alaska to spawn. The eggs are deposited on kelp, other seaweeds, rock substrate, and detritus in the shallower coastal zone. After spawning and hatching, both adult and larval herring remain in near-shore water until fall when the schools move to deeper and warmer waters to overwinter. Adults and larvae feed primarily on zooplankton (NMFS 2005). Larvae and juveniles feed and grow in estuaries and embayments, thus making them vulnerable to changes in inshore habitats. Herring are important food fishes for other pelagic fishes, and marine birds and mammals. They are also important target species in the diets of communities participating in subsistence fishing. The Southeast Alaska DPS of Pacific herring is a candidate for listing under ESA and is discussed further in Chapter 6.

4.3.1.2 Non-Commercially Harvested Species

Pacific sandlance and capelin are important as prey species for higher trophic levels. Dolly Varden is an important sport and subsistence fish throughout its range. A brief description of each of these species is provided below.

Pacific sandlance. Pacific sandlance are abundant in near-shore areas and bays and generally inhabit water less than 330 ft (100 m) deep. Sandlance lack a swim bladder and must actively swim, rest on the seafloor, or bury themselves in sand or fine gravel. They may form large pelagic schools during the day and return to the bottom at night. Sandlance spawn during winter in areas of strong currents. The larvae are planktonic and feed on diatoms, copepods, shrimp, and barnacle nauplii. Pacific sandlance are prey items for salmon, Pacific cod, halibut, other demersal fishes, marine birds, and mammals (NMFS 2005).

Capelin. Capelin is a pelagic species that forms large schools near the bottom. Spawning usually occurs in spring in the intertidal zone. Eggs are deposited on sandy beaches at night or on cloudy days following a high tide and are buried in the sand by wave action. Capelin consume copepods, amphipods, euphausiids, and shrimp and are important prey items for other fishes, marine birds and mammals (NMFS 2005).

Dolly Varden. Dolly Varden occur throughout Alaska from Southeast to the streams and rivers feeding the Beaufort Sea. They spawn mostly in the fall, with eggs incubating over winter. Many anadromous Dolly Varden are capable of repeated spawning, although they suffer a high post-spawning mortality and generally do not spawn in consecutive years.

4.3.2 Shellfish

Several major shellfish fisheries are managed by ADF&G within the Area of Coverage. The species include red king crab (*Paralithodes camtschaticus*), blue king crab (*P. platypus*), golden king crab (*Lithodes aequispinus*), Tanner crab (*Chionoecetes bairdi*), Dungeness crab (*Metacarcinus magister*), *pot and trawl shrimp* (*Pandalus borealis*, *P. goniurus*, *P. dispar*, *P.*

hypsinotis, and *P*. *platyceros*), and scallop (*Patinopecten caurinus*). Monitoring data for shellfish in the vicinity of LTFs is limited; however, historical reports indicate that red king crab and Dungeness crab have been observed near LTF facilities in Chatham Strait and Frederick Sound (Meyers 1977; Tetra Tech 1996).

4.4 BIRDS

Approximately 100 species of marine and coastal birds regularly occur in the Gulf of Alaska region. In general, loons, grebes, cormorants, sea ducks, eagles, gulls, and some alcids are year-round residents of the region. Other birds may be present seasonally or may migrate through the area on a seasonal basis (e.g., geese). The majority of the seabird population in the Gulf of Alaska is comprised of nine species. Almost all seabirds return to breeding colonies in April or May and lay eggs in May, June, or July. While seabirds are rearing young, foraging is limited to areas near the colony (5 to 40 mi [8 to 64 km] depending on the species). Most seabirds leave their breeding colonies by September and spend the next nine months at sea (Tetra Tech 1996).

Seabirds feed primarily on marine invertebrates and fishes. Seabird species usually depend on one or two prey species during the nesting season (Springer 1991). The major food sources during spring and months include capelin, sandlance, squid, juvenile pollock, and zooplankton. During winter, foods include various benthic invertebrates, demersal fish, and zooplankton (Tetra Tech 1996).

Major seabird colonies (100,000 individuals or more) within the general APDES permit area occur at Forrester, Petrel, and St. Lazaria Islands in Southeast Alaska; many smaller colonies exist in Cook Inlet, Prince William Sound, and the Kodiak Island area. Important nearshore wintering areas for seabirds such as auklets and murres include the bays of Kodiak Island, Afognak Island, Kachemak Bay, Prince William Sound, and southeastern Alaska. Cormorants and guillemots occupy all ice-free coasts year-round.

Hundreds of thousands of shorebirds of over 35 species use the coastal areas for feeding and resting as they migrate to breeding grounds in western and northwestern Alaska each year. These birds use sandy beaches, rocky shores, and intertidal mudflats as forage areas for small invertebrates such as clams and worms. The world population of surfbird (*Aphriza vergata*) and black turnstone (*Arenaria melanocephala*), and large numbers of dunlin (*Calidris alpina*) and short-billed dowitcher (*Limnodromus griseus*) migrate along the Alaskan coast. Other common shorebirds in coastal habitats include plovers (*Plurialis* spp.), whimbrel (*Numenius phaeopus*), godwits (*Limosa* spp.), and oystercatchers (*Haematopus bachmani*). Phalaropes feed at sea like seabirds, except when they are at their breeding grounds near freshwater ponds.

There are a limited number of mudflats in the migratory flyway between the Washington coast and western Alaska. Critical spring habitats for migrating shorebirds within the APDES permit areas include the Stikine River Delta (near Wrangell) and the Copper River Delta (including the Copper River Delta Critical Habitat Area and the Copper River Delta Shorebird Reserve Unit near Cordova).

Tetra Tech (1996) provided information on bird populations near a few LTFs in Southeast and Southcentral Alaska located along Chatham Strait (Cube Cove) and Frederick Sound. Bird species sighted near the Chatham Strait LTF include bald eagle (*Haliaeetus leucocephalus*), red- breasted merganser (*Mergus serrator*), common merganser (*Mergus merganser*), surf scoter (*Melanitta* *perspicillata*), harlequin duck (*Histrionicus histrionicus*), common goldeneye (*Bucephala clangula*), northwestern crow (*Corvus brachyrhynchos*), raven (*Corvus corax*), bufflehead (*Bucephala albeola*), Canada goose (*Branta canadensis*), great blue heron (*Arelea herodias*), double crested cormorant (*Phalaciocorax auritus*), common scoter (*Oidemia nigra*), and unidentified gull (Laridae).

Birds reported to occur at the Frederick Sound LTF include the mallard duck (*Anas platyrhynchos*), tundra swan (*Cygnus columbianus*), Canada goose, canvasback duck (*Aythya valisineria*), and unidentified gulls.

4.5 MARINE MAMMALS

Several species of marine mammals occur in the Area of Coverage. These species include cetaceans, pinnipeds, and sea otters. Non-endangered cetaceans include the northern minke whale (*Balaenoptera acutorostrata scammoni*), killer whale (*Orcinus orca*), beluga whale (*Delphinapterus leucas*) (beluga whales occupying Yakutat Bay are not listed under ESA), short-finned pilot whale (*Globicephala macrorhynchus*), Dall's porpoise (*Phocoenoides dalli*), harbor porpoise (*Phocoena phocoena*), Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), Risso's dolphin (*Grampus griseus*), northern right whale dolphin (*Lissodelphis borealis*), north Pacific giant bottlenose whale (*Hyperdon ampullatus*), Cuvier's beaked whale (*Ziphius cavirostris*), and Stejneger's beaked whale (*Mesoplodon stejnegeri*).

Nineteen species of non-endangered marine pinnipeds are resident or occur on a seasonal basis in the Gulf of Alaska. The most abundant of the species are the Steller sea lion (*Eumetopias jubatus*) (delisted east of 144°W longitude), northern fur seal (*Callorinus ursinus*), and Pacific harbor seal (*Phoca vitulina richardii*) (Tetra Tech 1996). Another non-endangered marine mammal in the Area of Coverage is the northern sea otter (*Enhydra lutris kenyoni*) (Southcentral Alaska and Southeast Alaska DPSs are not listed under ESA).

Northern fur seal. The northern fur seal has a range extending from southern California north to the Bering Sea. These seals are migratory and widely dispersed in pelagic waters throughout this range during the non-breeding season (November to May). During the summer breeding season, much of the population is found on the Pribilof Islands. While most fur seals migrate southward from Alaskan waters, a portion of the population, principally young non-breeding males, remain in the Gulf of Alaska year-round. The most recent population estimates for the Eastern Pacific stock of northern fur seals is 611,617. This number has dropped significantly since the late 1950s, resulting in the population being designated as depleted under the MMPA in 1988 (Allen and Angliss 2013).

Steller sea lion**.** The eastern DPS (east of 144°W longitude) lost its threatened status under ESA in November 2013 (78 FR 66140). Steller sea lions have a variety of prey including Pacific herring, salmon, cod, eulachon, capelin, walleye pollock, flatfish, rockfish, cephalopods, and occasionally birds or seals. They generally use exposed, offshore rookeries for breeding and pupping during the month of June. In winter, they move to more protected haulouts, which they use for resting between foraging trips (ADF&G 2008). The western DPS (west of 144°W) is listed as endangered under ESA and is further discussed in Chapter 6.

Pacific harbor seal**.** Pacific harbor seals tend to frequent nearshore waters and haul out on offshore rocks, sandbars, and beaches of remote islands. These seals often move considerable distances between various haulout sites, although they tend to have a limited number of preferred sites which they return to repeatedly. The breeding and pupping season occurs from late May through July. The diet of harbor seals is highly varied with prey primarily consisting of herring, eulachon, walleye pollock, octopus, salmon, shrimp, and flounder.

The harbor seal has an extensive range extending from the Bering Sea southward to Baja California. The current statewide abundance estimate is 152,602 based on aerial survey data collected during 1998-2007. Although the population has been in decline with no clear reason, none of the Alaskan stocks has been identified as depleted under the MMPA or considered for listing under the ESA (Allen and Angliss 2013).

***Dall's porpoise*.** The Dall's porpoise is present year-round throughout the Gulf of Alaska, with the largest numbers occurring over the continental shelf in spring and summer from Kodiak Island east to Icy Strait. Surveys conducted in 1999 and 2000 consistently showed Dall's porpoise in deeper water than harbor porpoise. Alaska populations were estimated to contain approximately 417,000 individuals based on observations collected in 1993; the estimate was revised downward to an estimated 83,400 based on inflated counts resulting from vessel attraction behavior. Surveys for this stock are over 20 years old, consequently there is no reliable abundance data for the Alaska stock of Dall's porpoise (Allen and Angliss 2013). This species usually travels in groups of 10 to 20 animals, although concentrations of over 1,000 porpoises may occur infrequently. The majority of breeding and calving takes place from June to August. Dall's porpoises feed on walleye pollock, sablefish, capelin, Pacific herring, sandlance, eulachon, and squid (ADF&G 2008).

***Harbor porpoise*.** The harbor porpoise ranges from Point Barrow south to Point Conception, California. They occur most frequently in waters less than 100 m deep. Based on aerial survey data collected in 1997, the estimated abundance of harbor porpoise in coastal and inside waters of Southeast Alaska was 11,146 (Allen and Angliss 2013). They are generally observed in harbors, fjords, bays, estuaries, and large rivers. The harbor porpoise feeds on fishes such as Pacific herring and walleye pollock, as well as squid and octopus (ADF&G 2008).

***Killer whale*.** Killer whales are large, long-lived dolphins and occur in stable social groups called pods. Two types of genetically distinct killer whales occur within the Area of Coverage and differ in behavior, ecology, and morphology: "resident" pods that concentrate on eating fish and "transient" pods that specialize on marine mammal prey (Allen and Angliss 2013). Resident killer whales primarily feed on salmon, which Chinook salmon being their preferred prey. The most common prey of transient killer whales is harbor seals. Sea lions and porpoises are also important prey items for transient whales (Ford et al. 1998).

***Beluga whale*.** A small group of less than 20 beluga whales are regularly observed in Yakutat Bay. An analysis of all documented sightings to date revealed that beluga whales have been observed in Yakutat Bay in all months except December and January. Most sightings were in Disenchantment Bay during spring and summer, suggesting seasonal patterns of habitat use. The regular observation of belugas in these waters in summer from 1997-2005 and the observation of a newborn calf in 2002 indicates the existence of a discrete, reproductive group of beluga whales some (1,000 km) distant from the nearest summering group in upper Cook Inlet (O'Corry-Crowe et al. 2006).

The ecology of Yakutat Bay beluga whales is also distinct. Current understanding of the ecology of beluga whales has been shaped, in part, by their apparent universal reliance on warm, shallow nearshore habitats in summer. The Yakutat belugas, by contrast, are the only group in Alaska that is associated with cold, glacial waters in summer (O'Corry-Crowe et al. 2006).

Preliminary genetic analysis suggests that the Yakutat beluga whales may be relatively more closely related to each other than to belugas sampled in other areas. These results indicate that the sampled whales are unlikely to be a random sample of the Cook Inlet population. This, taken with sighting data and behavioral observations suggests that these whales may be resident in the Yakutat Bay region year-round, and that these whales are reproductive, have a unique ecology and a restricted seasonal home range (O'Corry-Crowe et al. 2006).

Beluga whales from the Cook Inlet DPS occur rarely outside of Cook Inlet (Allen and Angliss 2013) and therefore are not likely occur in the Area of Coverage and are not discussed in this document.

***Northern sea otter*.** The northern sea otter is one of three recognized subspecies of sea otter. Their range extends from the Aleutian Islands in southwestern Alaska to the coast of Washington state. Once exploited to near extinction, northern sea otters in Alaska have reoccupied most of their known range since coming under protection under the International Fur Seal Treaty in 1911. Sea otters are extremely susceptible to marine pollution as their fur must remain clean to maintain its insulative qualities, and they seldom leave the water (70 FR 46366).

Three DPSs have been identified within Alaska: southwest, southcentral, southeast. The Southeast Alaska stock extends from Dixon Enterance to Cape Yakataga, the Southcentral Alaska stock extends from Cape Yakataga to Cook Inlet, and the Southwest Alaska stock includes the Aleutian, Barren, Kodiak, and Pribilof islands as well as the Alaska Peninsula coast (Allen and Angliss 2013). All three of these populations occur in the Area of Coverage. The southwest population is listed as threatened under the ESA and is discussed further in Chapter 6.

Based on recent surveys, there are an estimated 10,563 otters in the Southeast Alaska stock and 15,090 otters in the Southcentral Alaska stock (Allen and Angliss 2013). Otters tend to be non-migratory, moving relatively short distances between breeding and foraging areas. Sea otters generally occur in shallow water areas near the shoreline where they consume large quantities of benthic invertebrates, including sea urchins, mussels, clams, chitons, and crabs. Visual observation of 1,251 dives by sea otters in Southeast Alaska indicate that foraging activities typically occur in water depths ranging from 6 to 100 feet, although foraging at depths up to 328 feet was observed (Bodkin et al 2004).

4.6 SUMMARY

Nearshore marine waters in the Area of Coverage typically supports a diverse assemblage of marine life including plankton, algae, invertebrates, fish and shellfish, marine mammals, and birds. Although few data documenting the species composition of marine waters and shorelines near LTFs have been collected, available data supports this assertion. The current general APDES permit contains several provisions to avoid adverse impacts to biological communities. For example, the permit excludes discharges in the following areas:

1. Freshwater habitats, including streams, lakes, rivers, impoundments, and wetlands;
2. Within 300 ft (90 m) of the mouths of anadromous fish streams, or in areas known to be important for fish spawning or rearing;

3. On or adjacent to (i.e., near enough to affect) extensive tideflats, salt marshes, kelp or eelgrass beds, seaweed harvest areas, or shellfish concentration areas;
4. In areas having productive intertidal and subtidal zones;
5. In embayments with sills or other natural restrictions to tidal exchange; and
6. In areas where currents are not sufficient to disperse sunken or floating woody debris.

5.0 POTENTIAL IMPACTS OF LTFS ON MARINE ORGANISMS IN SOUTHEAST ALASKA

The determination of "unreasonable degradation" of the marine environment is to be based upon consideration of the ten criteria listed in Chapter 1. The following chapter provides information pertinent to consideration of the ocean discharge criteria listed below:

- **Criterion #1:** "The quantities, composition, and potential for bioaccumulation or persistence of the pollutants to be discharged"
- **Criterion #2:** "The potential transport of such pollutants by biological, physical, or chemical processes"
- **Criterion #6:** "The potential impacts on human health through direct or indirect pathways"

This chapter discusses the potential direct adverse effects of pollutants discharged from LTFs on marine organisms and human health in Southeast and Southcentral Alaska. The chapter is organized according to the following categories of discharges from LTF facilities:

- Bark and woody debris
- Leachates
- Petroleum products
- Miscellaneous minor pollutants

5.1 BARK AND WOODY DEBRIS

Bark and woody debris accumulations have been observed at active and inactive LTFs in the Area of Coverage (see Chapter 2.0) and the degradation rate of these materials appears to be very slow (see Chapter 3.0). If transport processes (i.e., wind-, tidal-, or storm-generated currents) do not remove and disperse discharged bark and woody debris, marine organisms in the receiving waters may be affected. Adverse effects are likely to occur through one or more of the following processes:

- Burial
- Alteration of Substrates
- Reduction of dissolved oxygen (DO) concentrations in sediments and waters, and
- Buildup of nonpriority pollutants such as ammonia and sulfides

Bark and woody debris are most likely to affect benthic organisms; invertebrates that are sessile or are capable of only limited movements are particularly susceptible to impacts.

Monitoring efforts near LTFs have documented distribution patterns of bark accumulation in water depths less than 60 ft (20 m) and the biological effects on benthic organisms (Table 5-1). The observed effects include reductions in abundance and growth of benthic infauna, reduced diversity of benthic infauna, reduced fitness and survival of bivalves, and reduced fitness and increased egg mortality in crab. While the observed biological effects may be due to the simultaneous stress of the above processes, each individual stressor is discussed below.

TABLE 5-1. OBSERVED ENVIRONMENTAL EFFECTS OF BARK AND WOODY DEBRIS ACCUMULATIONS AT LOG TRANSFER FACILITIES

Organism(s)	Effect	Reference
Dungeness crab (*Metacarcinus magister*)	Increased limb joint erosion, increased formation and severity of granulomas	Morado et al. 1988
Dungeness crab	Reduced percentage of ovigerous crabs, reduced fecundity, increased egg mortality	O'Clair and Freese 1988
Bivalves (*Protothaca staminea, Mytilus edulis*)	Reduced fitness and reduced survival under 6 cm of bark, 50 percent mortality after 96 days under bark depths of 12.8 cm (*P. staminea*) and 10.9 cm (*M. edulis*)	Freese and O'Clair 1987
Benthic infauna	Reduced abundances, reduced biomass	Jackson 1986
Amphipod (*Eogammarus confervicolus*)	Increased mortality, reduced growth rates, reduced abundance	Stanhope and Levings 1985
Benthic infauna, Benthic epifauna	Reduced diversity at bark concentrations >40 percent	Kathman et al. 1994
Benthic infauna	Reduced diversity under 1 cm of bark	Conlan and Ellis 1979
Benthic infauna	Reduced abundances	Smith 1977
Heart cockle (*Clinocardium nuttallii*)	Immobilized under 20 cm of bark	Chang and Levings 1976
Benthic epifauna, macroalgae	Reduced diversity	Schultz and Berg 1976
Benthic infauna	Reduced abundances	Pease 1974
Benthic epifauna, macroalgae	Reduced abundances	Ellis 1973
Benthic epifauna	Reduced abundances	McDaniel 1973

5.1.1 Burial

The extent to which burial by bark and woody debris adversely impacts an organism depends upon the amount of bark deposited, the deposition rate, the size of the deposited material in relation to the size of the organism, the burrowing ability of the organism, and mobility of the organism.

No studies are currently available that measure how the rate of wood deposition affects biological organisms. Gooday and Turley (1990) found that the rate of deposition of organic material may not be as important to benthic organisms as the type of material deposited. However, a few studies have examined the effect of various thicknesses of wood on benthic organisms. Conlan and Ellis (1979) have reported that as little as 0.4 in (1 cm) of bark reduced the diversity of the underlying benthic infauna population. Bark coverage 2.4 in (6 cm) deep reduced the survival of two bivalve species (*Protothaca staminea* and *Mytilus edulis*), and 8 in (20 cm) of bark coverage immobilized the heart cockle, *Clinocardium nuttallii* (Freese and O'Clair 1987; Chang and Levings 1976). McGreer et al. (1985) examined colonizing infauna in wood waste thicknesses of 0.4, 2, and 6 in (1, 5, and 15 cm) and found that the greatest diversity and abundance of infauna occurred for a wood waste thickness of 2 in (5 cm). The infauna assemblage in 0.4 in (1 cm) thickness of wood waste was similar to the assemblage observed at a reference site that had no wood waste. Kathman et al. (1994) examined benthic invertebrates (infauna) colonization in artificial mixtures of wood waste (not bark) and sediment in trays placed at an ocean depth of 75 ft (23 m) for 11 weeks (August-October) in British Columbia. The proportion of wood waste in the wood-sediment mixtures were 0, 20, 50, and 100 percent. Mean diversity of infauna compared to the 0 percent wood mixture increased 60 percent for the 20 percent wood mixture and slightly for the 50 percent wood mixture. The dominant taxa in all wood-sediment mixtures were bivalves and polychaetes, with significant numbers of teredo worms occurring in the 20 and 50 percent wood mixtures. Substantial changes in the species occurring in the mixtures were evident at the 50 percent wood mixture. The number of species declined in the 100 percent wood mixture; however, the abundance of the remaining wood-adapted species (mainly polychaetes and teredo worms) increased considerably relative to the other wood mixtures.

Current BMPs and remediation plan requirements in the Area of Coverage require remedial actions be considered when more than 1.0 acre has continuous bark coverage and a depth of 4 in (10 cm) of wood is measured at any point along multiple dive transects used to determine the areal extent of bark coverage. Despite this BMP, the potential does exist for bark and woody debris to cause adverse impacts to some species of the marine community. Benthic infauna and sessile epifauna are the organisms most likely to be adversely affected by deposits of bark and woody debris; their abundance and diversity is likely to be altered in the vicinity of LTF operations. The alteration of benthic habitat may also have some impact on local demersal species as the diversity and abundance of their prey may be altered.

5.1.2 Alteration of Substrate

The deposition of bark and woody debris on sediments in the vicinity of LTF operations alters the particle size distribution of surficial sediments, which in turn can result in changes to benthic populations that reside in and on the sediments. These changes may adversely affect organisms by disrupting feeding activities or efficiencies, altering the mobility of organisms, or reducing the recruitment potential of the site due to the presence of substrates inappropriate for inhabitation by the original benthic community (Tetra Tech 1996). Given the persistence of bark and woody debris, substrate alteration may modify the benthic community within an area receiving wood deposits for substantial periods of time, even decades, after the cessation of LTF operations. The specific types of colonizers and their succession on different wood falls may depend on a variety of factors, such as the geographic location, season, and the type and size of wood (Beinhold et al. 2013). Some species, especially sessile epifauna that are limited by available hard bottom substrate may benefit from bark and wood deposits as their available habitat for anchoring and growth may increase. For example, in the Eastern Mediterranean, the mussels *Bathymodiolus*, *Idas*, and *Thyasira*, the clams *Solemya and Acharax*, as well as tubeworms, including tubeworms of the genus *Sclerolinum* have also been found to colonize sunken wood (Beinhold et al. 2013).

5.1.3 Oxygen Reduction

The decomposition of bark and woody debris in seawater is comprised of two phases. The first phase, which occurs relatively rapidly, is mediated by heterotrophic bacteria. The second phase is slower involving lignin-decomposing fungi, and often boring organisms that increase access to the interior of the wood (Sedell and Duval 1985). These decomposition processes create a biochemical oxygen demand (BOD) that reduces DO concentration in both interstitial pore water and sediments.

The oxygen uptake of benthic bark deposits has been reported to range from 0.2 to 4.4 grams of oxygen per square meter per day (McKeown et al. 1968; Pease 1974; Schaumburg 1973). These rates are dependent upon a number of factors including water turbulence above the wood deposits, wood debris particle size, and disturbance (scouring) of the woody debris (Sedell and Duval 1985). If marine organisms are periodically, or chronically exposed to low oxygen concentrations (e.g., infauna under an accumulation of woody debris in a poorly flushed are of a bay) they could suffer mortality or sub-lethal effects. At Ward Cove, Alaska DO concentrations are depressed by approximately 0.5 mg/L due to wood residues derived primarily from pulp mill effluent (not bark and woody debris from LTFs) (Tetra Tech 2001). O'Clair and Freese (1988) sampled water quality at six bays adjacent to LTFs, both at the surface and 4 in (10 cm) above the bark pile. In all cases, there were no substantial differences in DO concentrations between background measurements at the water surface and in the samples collected above the bark piles. One benefit of reduced oxygen is that cellulose degradation was highest under anoxic conditions that supported anaerobic benthic bacteria, e.g. fermenters and sulfate reducers that supports the decomposition of the wood (Beinhold et al. 2013).

The total area of continuous bark coverage at active (10.6 acres) and inactive (6.2 acres) LTFs evaluated for this ODCE (see Chapter 2.0) was 16.8 acres. Given that this area is only a very small percentage of the available benthic habitat in nearshore waters of Southeast and Southcentral Alaska, bark and woody debris accumulations would appear to pose a negligible risk to the overall populations; however, local assemblages of organisms in the vicinity of individual LTF operations may be adversely affected.

5.1.4 Nonpriority Polluntants

Elevated ammonium concentrations have been observed at the wood chip-sediment boundary layer relative to background levels (Beinhold et al. 2013). It is the soluble unionized form of ammonia (NH_3) in marine water that can be highly toxic to aquatic life. The presence of NH_3 is dependent on pH, temperature and, to a lesser extent, salinity. The ADEC's chronic water quality criterion for NH_3 is 0.233 mg/L (ADEC 2008). The potential for adverse effects from ammonia is likely to be site-specific and is likely dependent on local pH, flushing and other factors.

Sulfur can either enhance or inhibit the viability of certain organisms. In the Eastern Mediterranean, wood-boring bivalves of the genus *Xylophaga* played a key role in the degradation of the wood logs, facilitating the development of anoxic zones and anaerobic microbial processes such as sulfate reduction (Beinhold et al. 2013). Sulfate tends to be nontoxic to most species, while sulfides can adversely affect some, but not all, sediment benthics at high concentrations. However, acid volatile sulfides can also reduce the toxicity of certain metals, such as cadmium, copper, lead, nickel, and zinc, to sediment benthos (Ankley et al. 1991; Di Toro et al. 1990, 1992; Pesch et al. 1995; Ankley et al. 1996a, b). In addition, the reduction of sulfate to sulfides has been shown to promote the establishment of chemosynthetic life in deep seas (Beinhold et al. 2013). For example, in deep-sea environments, core communities of cellulose-degrading microorganisms, including sulfate-reducing bacteria, can be established at sunken woods which facilitate the development of sulfidic niches, building stepping-stones for chemosynthetic life (Beinhold et al. 2013).

5.2 LEACHATES

Leachates from bark and woody debris can potentially cause four general classes of effects:

- Reduction of light levels
- Increased oxygen demand
- Reduction in pH
- Direct toxicity

While biological impacts may be due to the simultaneous stress of the above processes, each individual stressor is discussed below.

5.2.1 Reduction of Light Levels

The release of leachates from wood deposits may impart a yellow to brown coloration to the water due to the tannin, flavanoid, resin, or quinone compounds present in the leachate (Sedell and Duval 1985). While these effects would be diminished as the compounds are diluted and dispersed by local transport mechanisms, it is possible that local attached algae could be adversely affected through a reduction in photosynthesis. Highly colored waters have not been reported at LTFs in the Area of Coverage during any of the dive surveys that have been conducted near LTF operations (Tetra Tech 2005).

5.2.2 Increased Oxygen Demand

The release of leachates and their subsequent degradation can result in increased oxygen demand (Sedell and Duval 1985). Using an oxygen demand of 6.5 g O_2/m^2/day for hemlock log leachates as reported by Schaumburg (1973), Tetra Tech (2005) estimated that leachate degradation in the vicinity of two Southeast Alaska LTFs along Chatham Strait could potentially decrease ambient oxygen concentrations by 0.09 and 6.8 percent, respectively.

If organisms are exposed to oxygen reductions for extended periods of time (e.g., organisms near or under bark and woody debris in poorly flushed waters), reductions in fitness or mortality can occur. Effects from oxygen reductions due to leachate degradation are unlikely to exert large- scale oxygen demands in receiving waters in the Area of Coverage due to the relatively small area impacted by LTF operations. However, reduced oxygen levels in poorly flushed areas may impact local benthic infauna, sessile epifauna, and fish (Karna 2003).

5.2.3 Reduction in pH

Pease (1974) measured a reduction in pH in seawater exposed to a mixture of bark and wood leachates in the laboratory. Such reductions in pH could be quite harmful to marine organisms that typically experience only small pH changes due to the pH buffering capacity of seawater. However, the changes observed in the laboratory study are likely an artifact of using small volumes of water resulting in an unrealistically high ratio of bark/leachate volume to seawater volume.

5.2.4 Direct Toxicity

Wood waste leachate or degradation can result in the presence of compounds that can be toxic to aquatic life, including phenols, methylated phenols, benzoic acid, benzyl alcohol, terpense and tropolones (Kendall and Michelsen 1997). Tetra Tech (2005) compiled information on the toxicity of various bark leachates and extracts based on laboratory bioassay experiments for a number of test organisms (Table 5-2). These results showed that toxicity (measured as LC_{50} values) was extremely variable and differed among species, developmental stages, and the leachate source. Sitka spruce bark extract was more toxic to adult and larval pink shrimp and Dungeness crab larvae then hemlock bark extract; the opposite trend was observed for pink salmon fry.

TABLE 5-2. OBSERVED TOXICITY OF BARK AND WOOD LEACHATES IN SALTWATER

Organism(s)	Toxic Compound	Toxicity Measure	Toxic Level	Reference
Pink shrimp, adult (*Pandalus borealis*)	Sitka spruce bark extract	96 h LC_{50}	205 mg/L	Buchanan et al. 1976
	Hemlock bark extract	96 h LC_{50}	>1,000 mg/L	Buchanan et al. 1976
Pink shrimp, larvae	Sitka spruce bark extract	96 h EC_{50} 96 h LC_{50}	155 mg/L 415 mg/L	Buchanan et al. 1976
	Hemlock bark extract	96 h EC_{50} 96 h LC_{50}	490 mg/L >1,000 mg/L	Buchanan et al. 1976
Dungeness crab larvae (*Metacarcinus magister*)	Sitka spruce bark extract	96 h EC_{50} 96 h LC_{50}	225 mg/L 530 mg/L	Buchanan et al. 1976
	Hemlock bark extract	96 h EC_{50} 96 h LC_{50}	>1,000 mg/L >1,000 mg/L	Buchanan et al. 1976
Pink salmon fry (*Oncorhynchus gorbuscha*)	Sitka spruce bark extract	96 h LC_{50}	100-120 mg/L	Buchanan et al. 1976
	Hemlock bark extract	96 h LC_{50}	56 mg/L	Buchanan et al. 1976
Pink salmon fry	Yellow cedar leachate	96 h LC_{50}	150-200 mg/L	Pease 1974
	Hemlock leachate	96 h LC_{50}	>200 mg/L	Pease 1974
	Spruce leachate	96 h LC_{50}	>200 mg/L	Pease 1974
	Red cedar leachate	96 h LC_{50}	>200 mg/L	Pease 1974
Chinook salmon fry (*O. tshawytscha*)	Tannic acid	48 h LC_{50}	<1.7 ppm	Washington Department of Fisheries 1960

Tetra Tech (2005) estimated leachate concentration in receiving waters near an LTF located along Chatham Strait by assuming that 1 m^3 of woody debris contains 18.2 kg of leachates. Using the measured wood volume of 321 cubic meters near the Chatham Strait LTF, a water concentration of 0.09 mg/L leachates was estimated. This concentration was more than 100 times less than the leachate concentrations reported to show toxic effects in organisms (Table 5-2). Humans that rely on recreational or commercial fishing or shellfish harvesting could be adversely impacted if direct toxicity from marine wood disposal adversely impacts dependent aquatic life such as salmon and crab. However, the conclusion that leachates have negligible potential to cause toxic effects to marine organisms is supported by other authors that note that the toxicity of leachates in seawater is negligible because of the tendency for lignin substances to precipitate out of solution subsequent to reaction with the chloride ions naturally present in seawater (Pease 1974; Sedell and Duval 1985).

5.3 PETROLEUM PRODUCTS

The discharge of petroleum products into marine waters in the Area of Coverage could adversely affect marine biota. The potential for impacts depends upon the characteristics of the petroleum products released and the magnitude and frequency of discharge/spill events. Based on oil sheen monitoring reports provided over the thirteen-year period from 2000 through 2012, oil discharges from LTFs appear to occur infrequently (see Section 2.4.1) and, with the exception of one boating accident (see Section 2.4.2), release small quantities of petroleum to marine waters.

Petroleum compounds exhibit both lethal and sub-lethal effects on a variety of marine life. The severity of the effect is dependent upon a number of factors, including the composition of the petroleum product, exposure time, exposure concentration, and the species and life stage of the organism exposed to the petroleum release. Laboratory bioassays for a number of marine organisms including phytoplankton, macroalgae, crustaceans, molluscs, polychaetes, and fish show that concentrations of petroleum greater than 0.001 parts per million (ppm) can be toxic to some species (Connell and Miller 1981). The toxicity of petroleum products can vary substantially depending upon the compounds that comprise the product. The Lowest Observed Effect Concentrations (LOELs) determined for exposure to weathered crude oil for herring eggs (water exposure) and pink salmon (diet exposure) are 9,100 ppm and 13 ppm, respectively (Carls et al. 1996, 1999).

A definitive assessment of the potential risks of petroleum discharges from LTFs would require more information concerning the specific compounds present in released petroleum products and estimates of the exposure concentrations and exposure times that sensitive organisms would encounter. As noted above, given the relative infrequency of oil sheen events and the small quantities of petroleum products that are released, the risks to marine organisms is probably small. The greatest potential for adverse effects would be for those species that are sessile or remain in close proximity to LTF operations, and possibly, the oiling of birds. The chain conveyor transfer method for transferring logs has the greatest potential to introduce petroleum products to the marine environment; only two LTFs appear to be currently using this transfer method (see Table 2-2).

5.4 MISCELLANEOUS MINOR POLLUTANTS

The miscellaneous minor pollutants potentially discharged from LTFs in the Area of Coverage are not likely to cause large-scale disturbances to the marine communities present in the receiving waters. Effects on organisms due to miscellaneous minor pollutants are likely to be localized and would be minor in comparison with effects from other potential pollutants.

5.5 SUMMARY

Adverse environmental effects due to discharges from LTFs in the Area of Coverage may occur through several processes. Given the nature of the discharges and their persistence, benthic organisms that reside in or on the sediments, and particularly those that are sessile or have limited mobility to avoid discharge deposits or waste streams, are most likely to be affected. The accumulation of bark and woody debris on sediments can cause substantial changes in benthic community structure. Benthic organisms may be adversely affected by burial, substrate alteration, oxygen reduction, and nonpriority pollutants such as ammonium and sulfides. Substrate alteration is the most serious impact attributable to LTF operations due the persistence of wood deposits that may require years to decades to degrade. Burial of organisms by bark and woody debris is also a serious impact during LTF operations that can cause mortality of species. Discharges can also lower DO concentration in the water column and sediments due to the oxygen demand caused by the degradation of wood and leachates. Adverse effects in the water column are likely to occur only in areas that have limited water circulation.

The leaching of compounds from bark and woody debris may potentially cause coloration of waters, pH changes, increased oxygen demand, and toxic effects. Increased water coloration has not been observed at LTF sites, perhaps due to the tendency for leachates to precipitate out of solution in marine waters. Changes of pH, while observed in laboratory studies, are less likely to occur in the marine environment due to the buffering capacity of marine waters. Increased oxygen demand arising from the degradation of leachates is not likely to adversely affect organisms in receiving waters, with the possible exception of those organisms residing in areas that have limited water circulation. An assessment of the potential for leachate toxicity to occur is hindered by the general lack of toxicity data and the influence of site-specific conditions, the variable toxicity exhibited by leachate extracts, and because exposure depends upon the local water transport characteristics. However, based on estimates of potential water column concentrations, and the tendency for leachates to precipitate in marine waters, it is unlikely that leachate toxicity poses a substantial risk to marine organisms. Thus, humans that rely on recreational or commercial fishing or shellfish harvesting are unlikely to be adversely impacted due to the small potential for impacts to occur in aquatic populations such as salmon and crab.

Low concentrations of petroleum products introduced to marine waters can cause both lethal and sub-lethal effects on plant and animals species in the Area of Coverage. The potential for impacts depends upon the characteristics of the petroleum products released and the magnitude and frequency of discharge/spill events. Based on oil sheen monitoring reports over the thirteen-year period from 2000 through 2012, oil discharges from LTFs appear to occur infrequently and, with the exception of one boating accident, release small quantities of petroleum to marine waters. Therefore, the risk to marine organisms from these discharges is probably small. The greatest potential for adverse effects would be for those species that are sessile or remain in close proximity to LTF operations and the potential for localized oiling of a few birds. The chain conveyor transfer method for transferring logs has the greatest potential to introduce petroleum products to the marine environment.

Miscellaneous minor pollutants are likely to cause only localized impacts that would be minor in comparison with other potential pollutant effects.

6.0 THREATENED AND ENDANGERED SPECIES

The determination of "unreasonable degradation" of the marine environment is to be made based upon consideration of the ten criteria listed in Chapter 1. This chapter provides information pertinent to consideration of the criterion listed below:

- **Criterion 3:** "The composition and vulnerability of the biological communities which may be exposed to such pollutants, including the presence of unique species or communities of species, the presence of species identified as endangered or threatened pursuant to the Endangered Species Act, or the presence of those species critical to the structure or function of the ecosystem, such as those important for the food chain"

The Endangered Species Act (ESA) of 1973 defines an "endangered species" as a species that is in danger of extinction throughout all or a significant portion of its range. A "threatened species" is defined as a species that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range. This chapter provides an assessment of the potential adverse impacts to endangered and threatened species that are likely to occur in the Area of Coverage (Table 6-1).

The yellow-billed loon (*Gavia adamsii*) and the Southeast Alaska distinct population segment (DPS) of Pacific herring have been designated as candidates for listing under ESA (74 FR 12932; 73 FR 19824). Therefore, the yellow-billed loon and the Southeast Alaska DPS of Pacific herring will be addressed in this chapter as well.

The Cook Inlet DPS of beluga whale is listed as endangered under ESA (73 FR 62919). Beluga whales from this DPS occur rarely outside of Cook Inlet (Allen and Angliss 2013) and are therefore not included in this chapter.

TABLE 6-1. ENDANGERED SPECIES ACT THREATENED, ENDANGERED, AND CANDIDATE SPECIES THAT ARE FOUND IN THE AREA OF COVERAGE FOR THE APDES GENERAL PERMIT FOR LOG TRANSFER FACILITIES.

Common Name	Scientific Name	Population Segment	Current Status
Chinook Salmon	*Oncorhynchus tshawytscha*	Upper Columbia River Spring-run	Endangered
		Snake River Fall-run	Threatened
		Snake River Spring/ Summer-run	Threatened
		Lower Columbia River	Threatened
Sockeye Salmon	*O. nerka*	Snake River	Endangered
Coho Salmon	*O. kisutch*	Lower Columbia River	Threatened
Chum Salmon	*O. keta*	Columbia River	Threatened
		Hood Canal Summer-run	Threatened
Pacific Herring	*Clupea pallasii*	Southeast Alaska	Candidate[1]
Short-tailed Albatross	*Phoebastria albatrus*	Entire	Endangered

TABLE 6-1. ENDANGERED SPECIES ACT THREATENED, ENDANGERED, AND CANDIDATE SPECIES THAT ARE FOUND IN THE AREA OF COVERAGE FOR THE APDES GENERAL PERMIT FOR LOG TRANSFER FACILITIES.

Common Name	Scientific Name	Population Segment	Current Status
Steller's Eider	*Polysticta stelleri*	Alaska breeding population	Threatened
Yellow-billed Loon	*Gavia adamsii*	Entire	Candidate[1]
North Pacific Right Whale	*Eubalaena japonica*	Entire	Endangered
Sei Whale	*Balaenoptera borealis*	Entire	Endangered
Blue Whale	*B. musculus*	Entire	Endangered
Fin Whale	*B. physalus*	Entire	Endangered
Humpback Whale	*Megaptera novaeangliae*	Entire[2]	Endangered
Sperm Whale	*Physeter macrocephalus*	Entire	Endangered
Steller Sea Lion	*Eumetopias jubatus*	Western DPS	Endangered
		Eastern DPS	Delisted[3]
Northern Sea Otter	*Enhydra lutris kenyoni*	Southwest Alaska	Threatened

[1] Candidate species do not receive protection under ESA, but may be listed as endangered or threatened during the life of the APDES permit.

[2] The North Pacific population is under review for recognition as a DPS and delisting under the ESA.

[3] Delisted in November 2013.

6.1 GEOGRAPHIC DISTRIBUTION, CRITICAL HABITAT, AND IMPACT ASSESSMENT SUMMARIES

6.1.1 Chinook Salmon

Four evolutionarily significant units (ESU) of Chinook salmon (Upper Columbia River spring-run, Snake River fall-run, Snake River spring/summer-run, and Lower Columbia River) may occur within Southeast Alaska during the ocean phase of their life cycle. The upper Columbia River spring-run is listed as endangered and the three remaining ESUs are listed as threatened under the ESA.

Chinook salmon from additional ESA-listed Lower-48 ESUs may occur in the Area of Coverage but are not expected to occur in large numbers or on a regular basis. Although they are not explicitly addressed, the following discussion will likely be applicable to these ESUs as well.

6.1.1.1 Geographic Distribution

Despite extensive investigations, the ocean migratory and distribution patterns of Chinook remain poorly understood (Healy 1991). Chinook that exhibit a behavioral type referred to as "ocean-type", which includes Snake River fall-run fish, generally tend to remain closer to the coast during their ocean migration and not disperse more than about 620 mi (1,000 km) from their natal river (Healy 1991). Chinook exhibiting the other behavioral type referred to as “stream-type”, which includes Snake River spring/summer-run fish, overlap the distribution of the “ocean-type” fish but also extend their distribution much further offshore in North Pacific waters (Healy 1991).

The distribution and movements of the four ESA-listed populations of Chinook salmon in the Area of Coverage are unknown. The limited data available suggest that the shallow (< 60 ft [18 m]) near-shore waters in the vicinity of LTF operations may not be preferred by Chinook as ocean surveys have found they tend to be distributed deeper in the water column than other Pacific salmon species (Healy 1991). Taylor (1969) found that Chinook near Vancouver Island were most abundant at water depths of 187-239 ft (57-73 m) and at water depths of 66-121 ft (20-37 m) in the Strait of Georgia. Another survey by Argue (1970) found that most Chinook occurred at depths of 157-180 ft (48-55 m) in the Juan de Fuca Strait. The extent to which these depth preferences may vary for fish utilizing Southeastern Alaskan waters is unknown. The Pacific Salmon Commission estimates that a significant proportion of the Snake River fall-run Chinook (about 36 percent) are taken in Alaska and Canada, indicating a far-ranging ocean distribution (Tetra Tech 2004).

6.1.1.2 Critical Habitat

Critical habitat has been designated for all ESA-listed Chinook salmon ESUs. No designated critical habitat for these species occurs within the Area of Coverage.

6.1.1.3 Impact Assessment

LTF operations are confined to nearshore waters, with most facilities operating in water depths less than 60 ft (18 m). Chinook salmon in the ocean consume small fish, particularly herring, pelagic amphipods, and crab megalopa (Healy 1991). These prey species may be found in the vicinity of LTFs or prey upon other species that may be impacted by the alteration of bottom substrate by the accumulation of bark and woody debris. However, the limited areal extent of LTF accumulations of woody debris, the widespread distribution of available prey, and the mobility of adult Chinook salmon suggests that these impacts would limit the effect on ESA-listed populations of Chinook.

The release of leachates and petroleum products from LTFs may cause toxicity that could conceivably affect Chinook or their prey. However, these effects are most likely in close proximity to LTF operations as the chemicals causing toxicity would be diluted as they are dispersed by local currents and storm events. The limited areal extent of LTF accumulations of woody debris, widespread distribution of available prey, and mobility of adult Chinook suggest these impacts would limit the effect on ESA-listed populations of Chinook.

The decomposition of bark, woody debris, and released leachates from LTF operations can exert an oxygen demand that will reduce DO concentrations in the sediments and overlying waters. The reduced DO concentrations could adversely impact Chinook prey species either directly or by altering their food resources. Direct effects of low DO on adult Chinook are unlikely as the fish could avoid waters low in DO, which are likely to be confined to areas near LTFs that have limited water circulation.

Based on an assessment of potential impacts to Upper Columbia River spring-run, Snake River fall-run, Snake River spring/summer-run, and Lower Columbia River Chinook salmon, it is concluded that LTF operations under APDES GPs are **Not Likely to Adversely Affect (NLAA)** these populations.

6.1.2 Sockeye Salmon

The Snake River sockeye salmon population, which was listed as endangered in 1991, may occur within Southeast Alaska during the ocean phase of their life cycle.

6.1.2.1 Geographic Distribution

Snake River sockeye juveniles migrate almost 900 mi (1450 km) along portions of the Snake and Columbia Rivers to the Pacific Ocean. Out-migrating juveniles pass Lower Granite Dam (the first dam on the Snake River downstream from the Salmon River) from late April to July, with peak passage from May to late June (Tetra Tech 2004). Once in the ocean, the smolts remain inshore or within the Columbia River influence during the early summer months. After this period, the fish migrate through the northeast Pacific Ocean (Hart 1973). Detailed information on the ocean movements of Snake River sockeye is lacking; however, it appears that there is considerable overlap in the migratory distribution of sockeye salmon originating in rivers of the northeastern Pacific Ocean from the Columbia River to the Alaska Peninsula (Burgner 1991). In the Gulf of Alaska, British Columbia-Washington stocks tend to be distributed farther to the south (to 46ºN latitude) than Alaskan stocks of sockeye, but they utilize the general area south and east of Kodiak Island together with the Alaskan stocks (Burgner 1991). Snake River sockeye salmon usually spend 2 to 3 years in the Pacific Ocean.

6.1.2.2 Critical Habitat

The critical habitat for the Snake River sockeye salmon was designated on December 28, 1993 (58 FR 68543). The designated habitat consists of the river reaches of the Columbia, Snake, and Salmon rivers, Alturas Lake Creek, Valley Creek; and Stanley, Redfish, Yellow Belly, Pettit, and Alturas lakes (including their inlet and outlet creeks). No critical habitat is designated for ocean waters, therefore, no designated critical habitat for Snake River sockeye salmon occurs within the Area of Coverage.

6.1.2.3 Impact Assessment

LTF operations are confined to nearshore waters, with most facilities operating in water depths less than 60 ft (18 m). Sockeye in the ocean are opportunistic feeders and their diet varies depending upon the availability and relative abundance of food items. Major prey can consist of euphausiids, hyperiid amphipods, and small fish, with copepods, pteropods, and crustacean larvae forming a smaller proportion of the diet (Burgner 1991). Some authors have reported that the fish seek out areas of high macrozooplankton abundance (McAllister et al. 1969). These prey species may be found in the vicinity of LTFs or prey upon other species that may be impacted by the alteration of bottom substrate by the accumulation of bark and woody debris. However, the limited areal extent of LTF accumulations of woody debris, widespread distribution of available prey, and mobility of sockeye would limit the effect on Snake River sockeye salmon.

The release of leachates and petroleum products from LTFs may cause toxicity that could conceivably affect sockeye or their prey. However, these effects are most likely in close proximity to LTF operations as the chemicals causing toxicity would be diluted as they are dispersed by local currents and storm events. While considerable meandering is known to occur during feeding, sockeye appear to be almost continuous travelers during their ocean migrations (Burgner 1991), and are unlikely to remain for extended periods in the vicinity of LTF operations. The limited areal extent of LTF accumulations of woody debris, the widespread distribution of available prey, and the mobility of sockeye would limit the effect on Snake River sockeye.

The decomposition of bark and woody debris and released leachates from LTF operations can exert an oxygen demand that will reduce DO concentrations in the sediments and overlying waters. The reduced DO concentrations could adversely impact sockeye prey species either directly or by altering their food resources. However, the widespread distribution of available prey would limit the effect on sockeye. Direct effects of low DO on Snake River sockeye are very unlikely as the fish could avoid any low DO waters.

Based on an assessment of potential impacts to Snake River sockeye salmon, it is concluded that LTF operations under the APDES GPs are **Not Likely to Adversely Affect (NLAA)** this species.

6.1.3 Coho Salmon

Coho salmon from the Lower Columbia River ESU may occur within Southeast Alaska during the ocean phase of their life cycle. Lower Columbia River coho salmon are listed as threatened under the ESA.

6.1.3.1 Geographic Distribution

Lower Columbia River salmon are typically categorized into early- and late-returning stocks. Early-returning (Type S) adult coho salmon enter the Columbia River in mid-August and begin entering tributaries in early September, with peak spawning from mid-October to early November. Late-returning (Type N) coho salmon pass through the lower Columbia from late September through December and enter tributaries from October through January. Most spawning occurs from November to January, but some occurs as late as March. Most juvenile coho migrate seaward in April to June, typically during their second year. Adult Lower Columbia River coho typically range throughout the nearshore ocean over the continental shelf. Early-returning (Type S) coho salmon are typically found in ocean waters south of the Columbia River mouth. Late-returning (Type N) coho salmon are typically found in ocean waters north of the Columbia River mouth. They spend one to two years feeding in the ocean before returning to the Columbia River to spawn (NMFS 2013).

6.1.3.2 Critical Habitat

No critical habitat for coho salmon occurs within the Area of Coverage for the general ADPES permit.

6.1.3.3 Impact Assessment

Coho salmon in the ocean consume mainly fish and squid (NMFS 2005). These prey species may be found in the vicinity of LTFs or prey upon other species that may be impacted by the alteration of bottom substrate by the accumulation of bark and woody debris. However, the limited areal extent of LTF accumulations of woody debris, the widespread distribution of available prey, and the mobility of adult coho salmon suggests that these impacts would limit the effect on the Lower Columbia River population of coho.

The release of leachates and petroleum products from LTFs may cause toxicity that could conceivably affect coho or their prey. However, these effects are most likely in close proximity to LTF operations as the chemicals causing toxicity would be diluted as they are dispersed by local currents and storm events. The limited areal extent of LTF accumulations of woody debris, widespread distribution of available prey, and mobility of adult coho suggest these impacts would limit the effect on the Lower Columbia River population of coho.

The decomposition of bark, woody debris, and released leachates from LTF operations can exert an oxygen demand that will reduce DO concentrations in the sediments and overlying waters. The reduced DO concentrations could adversely impact coho prey species either directly or by altering their food resources. Direct effects of low DO on adult coho are unlikely as the fish could avoid waters low in DO, which are likely to be confined to areas near LTFs that have limited water circulation.

Based on an assessment of potential impacts to Lower Columbia River coho salmon, it is concluded that LTF operations under the APDES GPs are **Not Likely to Adversely Affect (NLAA)** this population.

6.1.4 Chum Salmon

Two ESUs of chum salmon (Hood Canal summer-run and Columbia River) may occur within the Area of Coverage during the ocean phase of their life cycle. Both populations are listed as threatened under the ESA.

6.1.4.1 Geographic Distribution

Hood Canal summer-run and Columbia River chum belong to two different races of chum salmon: summer and fall. Adult chum salmon returning to the Columbia River at the present time are virtually all fall-run fish, entering fresh water from mid-October through November and spawning from early November to late December (NMFS 2013). Hood Canal summer-run chum spawn from late August through late October (WDFW and Point No Point Treaty Tribes 2000).

Chum fry emerge at night and immediately migrate downstream to estuaries where they rear for weeks to months. Chum salmon spend two to four years in northeast Pacific Ocean feeding areas prior to migrating southward during the summer months as maturing adults along the coasts of Alaska and British Columbia on the way to their natal streams to spawn (WDFW and Point No Point Treaty Tribes 2000; NMFS 2013)

6.1.4.2 Critical Habitat

Critical habitat was designated in 2005 for Columbia River and Hood Canal summer-run chum salmon (70 FR 52630). No critical habitat for chum salmon occurs within the Area of Coverage for the general ADPES permit.

6.1.4.3 Impact Assessment

Chum salmon in the ocean consume amphipods, euphausiids, pteropods, copepods, gelatinous zooplankton, fish, and squid larvae (NMFS 2005). These prey species may be found in the vicinity of LTFs or prey upon other species that may be impacted by the alteration of bottom substrate by the accumulation of bark and woody debris. However, the limited areal extent of LTF accumulations of woody debris, the widespread distribution of available prey, and the mobility of adult chum salmon suggests that these impacts would limit the effect on ESA-listed populations of chum.

The release of leachates and petroleum products from LTFs may cause toxicity that could conceivably affect chum or their prey. However, these effects are most likely in close proximity to LTF operations as the chemicals causing toxicity would be diluted as they are dispersed by local currents and storm events. The limited areal extent of LTF accumulations of woody debris, widespread distribution of available prey, and mobility of adult chum suggest these impacts would limit the effect on ESA-listed populations of chum.

The decomposition of bark, woody debris, and released leachates from LTF operations can exert an oxygen demand that will reduce DO concentrations in the sediments and overlying waters. The reduced DO concentrations could adversely impact chum prey species either directly or by altering their food resources. Direct effects of low DO on adult chum are unlikely as the fish could avoid waters low in DO, which are likely to be confined to areas near LTFs that have limited water circulation.

Based on an assessment of potential impacts to Columbia River and Hood Canal summer-run chum salmon, it is concluded that LTF operations under the APDES GPs are **Not Likely to Adversely Affect (NLAA)** these populations.

6.1.5 Pacific Herring

The Southeast Alaska DPS of Pacific herring became a candidate for listing under ESA in April 2008.

6.1.5.1 Geographic Distribution

The Southeast Alaska DPS of Pacific herring extends from Dixon Entrance northward to Cape Fairweather and Icy Point and includes all Pacific herring stocks in Southeast Alaska. Pacific herring are located in distinctly varying environments during different times of the year. Adult herring migrate inshore, entering estuaries to breed once per year. During this time, they do not feed. Pacific herring spawn in shallow areas along shorelines; the eggs are deposited on kelp, eelgrass, and other available structures. In Southeast Alaska, spawning begins in mid-March. After spawning, the adult herring return to their summer feeding areas.

6.1.5.2 Impact Assessment

The Pacific herring is a coastal schooling species. They are found in large schools in depths from the surface to 1,300 ft (400 m). In spring, they spawn in shallow areas along shorelines between the subtidal and intertidal zones. Eggs are deposited on kelp, eelgrass, and other available structures (NMFS 2012). The eggs are adhesive, and survival is better for those eggs which stick to intertidal vegetation than for those which fall on the bottom (ADF&G 2007). After hatching, herring larvae remain in nearshore waters close to their spawning grounds where they feed and grow in the protective cover of shallow water habitats. After 2 to 3 months, the larvae metamorphose into juveniles. During the summer of their first year, these juveniles form schools in shallow bays, inlets and channels. These schools disappear in the fall and then move to deep water for the next 2 to 3 years. Young herring feed mainly on crustaceans, but also eat decapod and mollusk larvae (NMFS 2012).

Accumulation of bark and woody debris from LTF operations may physically smother aquatic vegetation beds that Pacific herring rely on for spawning and egg survival. The Alaska Timber Task Force Guidelines included in the general APDES permit exclude sensitive habitats such as kelp or eelgrass beds for the siting of new LTFs.

The release of leachates and petroleum products from LTFs may cause toxicity that could conceivably affect Pacific herring or their prey. However, these effects are most likely in close proximity to LTF operations as the chemicals causing toxicity would be diluted as they are dispersed by local currents and storm events. Their mobility would limit the effect on adult and juvenile Pacific herring; however, eggs and larvae are not independently mobile and would not be able to avoid LTF discharges.

The decomposition of bark and woody debris and released leachates from LTF operations can exert an oxygen demand that will reduce DO concentrations in the sediments and overlying waters. The reduced DO concentrations could adversely impact Pacific herring and their prey. Adult and juvenile herring could swim away from areas of low DO concentrations, but eggs and larvae could not.

Based on an assessment of potential impacts to the Southeast Alaska DPS of Pacific herring, and the preference of this species for nearshore estuarine habitat for spawning and rearing, it is concluded that LTF operations under the APDES GPs **may affect, but is not likely to adversely affect** this species.

6.1.6 Short-tailed Albatross

The short-tailed albatross was listed as endangered under the ESA in 2000.

6.1.6.1 Geographic Distribution

The short-tailed albatross once ranged throughout most of the North Pacific Ocean and Bering Sea. Breeding colonies of the short-tailed albatross are currently known on two islands in the western North Pacific and East China Sea. Torishima Island, the main nesting island, is controlled by Japan and is protected as a National Monument. Ownership of the second island, Minami-Kojima, is disputed. This island is claimed by Japan and China (by both the Republic of China located on Taiwan and by the People's Republic of China). Due to an error, the Fish and Wildlife Service mistakenly designated this species as endangered throughout their range except in the U.S. In November 1998, the Service announced a proposed rule to include the U.S. in the protected range of this species (63 FR 58692). Most sightings of this species in Alaskan waters occur in the Bering Sea, Aleutian Islands, and Gulf of Alaska (ADF&G 2004).

6.1.6.2 Critical Habitat

No critical habitat for short-tailed albatross has been designated.

6.1.6.3 Impact Assessment

Short-tailed albatross adults spend the summer non-breeding season at sea feeding on squid, fish, and other organisms that occur in near-surface waters (ADF&G 2004). No information exists on the frequency with which these birds may come near LTF operations; however, they are primarily pelagic birds spending most of their non-breeding and chick rearing time away from the coastline. They are not expected to frequent nearshore areas where LTFs are located on a regular basis.

Short-tailed albatross have the greatest potential to be impacted by LTF operations through the release of petroleum discharges.. However, given that LTFs have generally release petroleum infrequently and in small quantities, and that the discharges are expected to be limited to relatively small areas around the LTFs, it is unlikely that short-tailed albatross would be near any of these sites and be adversely affected. LTF operations are not expected to affect the bird's prey species or cause any adverse indirect effects to the species. Thus, it is concluded that LTF operations under the APDES GPs will have **No Effect** on this species.

6.1.7 Steller's Eider

The Alaskan breeding populations of the Steller's eider was listed as threatened under the ESA in 1997.

6.1.7.1 Geographic Distribution

Three breeding ranges of Steller's eiders are recognized, two in Arctic Russia and one in Alaska (65 FR 13262). In recent times, breeding has occurred in two general areas outside of the Area of Coverage. These areas are the Arctic Coastal Plain and on the Yukon-Kuskokwim Delta in western Alaska. Historically, the breeding range may have extended from the eastern Aleutian Islands to the western and northern Alaskan coasts, possibly as far east as the Canadian border (65 FR 13262). Following the breeding season, Steller's eiders migrate south to the Alaska Peninsula where they undergo a flightless molt for about three weeks. The birds primarily molt outside of the Area of Coverage, in Izembek Lagoon, Herendeen Bay, and Port Moller on the Alaska Peninsula, but are known or thought to molt in a number of other locations along the northwestern Alaska coast, around islands in the Bering Sea and along the coast of Bristol Bay. Wintering birds occupy shallow, near-shore marine waters in much of southwestern and southern coastal Alaska. They are found around islands and along the coast of the Bering Sea and North Pacific Ocean from the Aleutian Islands, along the Alaska Peninsula and Kodiak Archipelago, east to lower Cook Inlet.

The winter range from the Kodiak Island east to lower Cook Inlet overlaps the Area of Coverage. Steller's eiders are considered a common winter resident in the Kodiak Archipelago (65 FR 13262). Aerial surveys in nearshore areas of eastern and southern Kodiak Island located flocks of hundreds of birds, particularly in lagoons and eelgrass beds.

6.1.7.2 Critical Habitat

The critical habitat designated for the Steller's eider includes breeding habitat on the Yukon-Kuskokwim Delta, and four areas in Southwest Alaska marine waters, including the Kuskokwim Shoals in northwest Kuskokwim Bay, Seal Islands, Nelson Lagoon, and Izembek Lagoon on the north side of the Alaska Peninsula. No critical habitat is designated within the Area of Coverage.

6.1.7.3 Impact Assessment

Steller's eiders are diving ducks that spend most of the year in shallow, nearshore marine waters and their winter range includes a portion of the Area of Coverage from Kodiak Island east to lower Cook Inlet. Observations around Kodiak Archipelago have observed flocks of birds in lagoons and eelgrass beds. These birds feed in surface waters and consume aquatic insects, mollusks, and crustaceans. During the winter, Steller's eiders are reported to consume the common blue mussel and amphipods (Tetra Tech 2004).

Steller's eider may be impacted directly by noise and vessel traffic associated with LTF operations, petroleum discharges, and by impacts to prey species due to discharges of bark and woody debris and releases of leachates. Currently, only two LTFs (Lookout Cove, Figure 3 and Barefoot Beach, Figure 3) are located within the geographical range currently occupied by Steller's eider, so the area of potential disturbance is extremely small relative to the total wintering area available. Aerial observations of wintering flocks suggest that the species is most likely to be found in ecologically productive areas (e.g., eelgrass beds) where it can more easily find potential prey items. The Alaskan Timber Task Force Guidelines included in the general APDES permit exclude these types of areas for the siting of new LTFs and suggest that LTFs be located in the "least ecologically productive intertidal and subtidal zones". The post-1985 LTF GP currently requires the applicant must consult with the U.S. Fish and Wildlife Service for sites within waters surrounding the Kodiak or Afognak Islandsto determine if proposed discharges will affect the wintering activities of the Steller's eider.

Based on an assessment of potential impacts to Steller's eider, and the preference of this species for nearshore habitat and prey species that can be adversely impacted by LTF facilities, it is concluded that LTF operations under the APDES GPs **may affect, but is not likely to adversely affect** this species.

6.1.8 Yellow-billed Loon

The yellow-billed loon became a candidate for listing under ESA in March 2009.

6.1.8.1 Geographic Distribution

Yellow-billed loons are migratory birds that nest near lakes in the Arctic tundra of parts of northern Alaska, Canada, and Russia. They winter regularly but sparsely in protected, nearshore marine waters from Kodiak Island through Prince William Sound, and throughout Southeast Alaska and British Columbia. The wintering range of the yellow-billed loon overlaps the entire Area of Coverage. Breeding adults occupy their wintering grounds from mid-November through April. Immature birds and nonbreeding adults remain on wintering ground throughout the year (Earnst 2004).

6.1.8.2 Impact Assessment

Yellow-billed loons are large diving birds that are be found throughout the Area of Coverage in winter, with immatures and nonbreeding adults present year round. They are opportunistic feeders that primarily consume invertebrates and small fish (Earnst 2004).

Yellow-billed loons may be impacted directly by noise and vessel traffic associated with LTF operations, petroleum discharges, and by impacts to prey species due to discharges of bark and woody debris and releases of leachates.

Based on an assessment of potential impacts to yellow-billed loons, and the preference of this species for nearshore habitat and prey species that can be adversely impacted it is concluded that LTF operations under the APDES GPs **may affect, but is not likely to adversely affect** this species.

6.1.9 North Pacific Right Whale

The North Pacific right whale was listed as endangered under the ESA in 1973 where it appeared as the "northern right whale." It was originally listed as endangered under the Endangered Species Conservation Act, the precursor to the ESA, in 1970. In 2008, NMFS listed the endangered northern right whale (*Eubalaena* spp.) as two separate, endangered species: North Pacific right whale (*E. japonica*) and North Atlantic right whale (*E. glacialis*).

6.1.9.1 Geographic Distribution

North Pacific right whales are found in temperate and subpolar waters in the Pacific ocean. The North Pacific whales are divided into two populations: eastern and western. The eastern population, which includes the whales in Alaskan waters, is more severely depleted than the western population (NMFS 2002). Between 1900 and 1994 there have been only 29 reliable sightings of right whales in the eastern North Pacific. Since that time, between 4 and 13 individuals have been sighted each year; all of these sightings have occurred in the southeastern Bering Sea in areas over the middle continental shelf (Center for Biological Diversity 2000; NMFS 2002). A reliable estimate of minimum abundance for the eastern stock of North Pacific right whales is 25.7 (Allen and Angliss 2013). Because the North Pacific eastern population is so small and infrequently sighted, little is known about their range and habitats. It is believed the whales summer in the Bering Sea and Gulf of Alaska and may winter as far south as Baja, California. Historically, right whales often were observed in coastal waters where their slow speed and tendency to float after death resulted in their near-decimation by whalers in the 1800's.

6.1.9.2 Critical Habitat

Critical habitat in the Gulf of Alaska and in the Bering Sea was designated for the northern right whale in 2006 (71 FR 38277). Following the 2008 decision to list the North Pacific right whale as a separate species, the same two critical habitat areas that had been designated for the northern right whale in 2006 were designated for the North Pacific right whale (73 FR 19000). The Gulf of Alaska and Bering Sea critical habitat areas are outside the waters of the State of Alaska and do not overlap with the Area of Coverage.

6.1.9.3 Impact Assessment

No observations of North Pacific right whales have occurred in the vicinity of LTF operations or in the Area of Coverage. The whales may migrate along the coast from areas where they have been sighted in the Bering Sea southward to winter as far south as Baja, California, but currently these movements are speculative. Any impacts from LTF noise or petroleum releases would be expected to be negligible given the whale's ability to move away from these effects.

Based on an assessment of impacts to North Pacific right whale, it is concluded that LTF operations under the APDES GPs are **Not Likely to Adversely Affect (NLAA)** this species.

6.1.10 Sei Whale

The sei whale was listed as endangered under the ESA in 1970.

6.1.10.1 Geographic Distribution

In the North Pacific, the endangered sei whale occurs mainly south of the Aleutian Islands. The largest population of sei whales occurs just east of Portlock Bank off the coast of the Kenai Peninsula in summer. The eastern Pacific stock migrates northward east of Kodiak Island during April through June. The whales migrate through the area again southward during the fall in November and December. In spring, substantial numbers of whales occur in the waters off the northeast coast of Kodiak Island, although the location of seasonal concentrations varies depending on prey availability (Tetra Tech 1996).

6.1.10.2 Critical Habitat

Critical habitat for the sei whale has not been established.

6.1.10.3 Impact Assessment

No observations of sei whales have been recorded in the vicinity of LTF operations. Any impacts from LTF noise or petroleum releases would be expected to be negligible given the whale's ability to move away from these effects.

Based on an assessment of impacts to sei whale, it is concluded that LTF operations under the APDES GPs are **Not Likely to Adversely Affect (NLAA)** this species.

6.1.11 Blue Whale

The blue whale was listed as endangered under the ESA in 1970.

6.1.11.1 Geographic Distribution

Blue whales inhabit every ocean of the world, from the equator to the poles. The largest animal that ever lived, this endangered species migrates annually to polar waters to feed in the summer; then returns to temperate and tropical waters for winter breeding. Blue whales concentrate in an area just south of the Aleutian Islands; beginning a southward migration out of the Gulf of Alaska in September to southern North American waters (Tetra Tech 1996).

6.1.11.2 Critical Habitat

Critical habitat for the blue whale has not been established.

6.1.11.3 Impact Assessment

Blue whales are generally considered an open-ocean species and would not be expected to occur in nearshore waters in the vicinity of LTF operations. Based on an assessment of impacts to blue whale, it is concluded that LTF operations under the APDES GPs would have **No Effect** on this species.

6.1.12 Fin Whale

The fin whale was listed as endangered under the ESA in 1970.

6.1.12.1 Geographic Distribution

Fin whales are baleen whales found in offshore waters throughout the North Pacific Ocean from Baja California to the Chukchi Sea. High concentrations of these endangered animals inhabit the Kodiak Island/northern Gulf of Alaska and southeastern Bering Sea in the summer. They have been observed in waters of the Alaska Maritime National Wildlife Refuge and the Kodiak National Wildlife Refuge. There are currently no reliable abundance estimates for the entire Alaska (Northeast Pacific) stock of fin whales. The estimate of 5,700 whales is considered a minimum for this stock, since surveys only covered a small part of the range (Allen and Angliss 2013).

6.1.12.2 Critical Habitat

Critical habitat for the fin whale has not been established.

6.1.12.3 Impact Assessment

No observations of fin whales have been recorded in the vicinity of LTF operations. Any impacts from LTF noise or petroleum releases would be expected to be negligible given the whale’s ability to move away from these effects.

Based on an assessment of impacts to fin whale, it is concluded that LTF operations under the APDES GPs are **Not Likely to Adversely Affect (NLAA)** this species.

6.1.13 Humpback Whale

The humpback whale was listed as endangered under the ESA in 1970.

6.1.13.1 Geographic Distribution

Humpback whales inhabit all major ocean basins from the equator to subpolar latitudes and are often sighted in shallow coastal waters. The central North Pacific migratory stock of humpback whales travels from Hawaiian wintering grounds to summering areas in Southeast Alaska each year (NMFS 2005). In inside waters off southeastern Alaska (i.e., Glacier Bay and Frederick Sound) photo-identification studies appear to show that humpback whales use discrete, geographically isolated feeding areas which individual whales return to year after year (NMFS 2005).

6.1.13.2 Critical Habitat

Critical habitat for the humpback whale has not been established.

6.1.13.3 Impact Assessment

Humpback whales generally feed for six to nine months in Alaskan waters. The whales eat primarily small schooling fish such as herring, capelin, pollock, and sandlance, but also commonly consume euphausiids, copepods, juvenile salmonids, Arctic cod, walleye pollock, pteropods, cephalopods, and shrimp (NMFS 2005). Some of these prey species may be found in the vicinity of LTFs or prey upon other species that may be impacted by the alteration of bottom substrate by the accumulation of bark and woody debris. However, the limited areal extent of LTF accumulations of woody debris, the widespread distribution of available prey, and the mobility of humpback whales would limit the effect on the humpback whales.

The release of leachates and petroleum products from LTFs may cause toxicity that could conceivably affect prey species consumed by humpback whales. However, these effects are most likely in close proximity to LTF operations as the chemicals causing toxicity would be diluted as they are dispersed by local currents and storm events. Given the limited areal extent of LTF accumulations of woody debris, the widespread distribution of available prey, and the mobility of humpback whales would limit the effect on the whales.

Noise levels in the vicinity of LTF operations have not been measured. Studies cited in NMFS (2005) reported that humpback whales did not exhibit avoidance behaviors at levels up to 116 dB; however, responses to noise are variable. Humpback whales may modify their behavior in the vicinity of active LTFs due to operational noise and vessel movements associated with operations. Whale identification studies suggest that individual whales may preferentially frequent the same feeding areas year after year. The potential displacement or disruption to humpback whales in the vicinity of some LTF sites suggests that this species could potentially modify its behavior in the vicinity of LTF operations.

Based on an assessment of impacts to humpback whale, it is concluded that LTF operations under the APDES GPs are **Not Likely to Adversely Affect (NLAA)** this species.

6.1.14 Sperm Whales

Sperm whales were listed as an endangered species under the ESA in 1970.

6.1.14.1 Geographic Distribution

The largest of all the toothed whales, sperm whales occur in all the world's oceans, from the equator to polar waters. They rarely enter semi-enclosed areas, but instead prefer oceanic habitat (Tetra Tech 2004). These whales also tend to inhabit waters greater than 600 ft (183 m) in depth, and only rarely occur in waters less than 300 feet (91 m) deep.

6.1.14.2 Critical Habitat

Critical habitat for the sperm whale has not been established.

6.1.14.3 Impact Assessment

Sperm whales are generally considered an open-ocean species and would not be expected to occur in nearshore waters in the vicinity of LTF operations. Based on an assessment of impacts to sperm whale, it is concluded that LTF operations under the APDES GPs would have **No Effect** on this species.

6.1.15 Steller Sea Lions

The Steller sea lion was listed as threatened under the ESA in 1990. In 1997, NMFS classified Steller sea lions into two DPSs divided by 144ºW longitude (which intersects the Alaskan coastline near Cape Suckling). The western DPS consists of all Steller sea lions from breeding colonies located west of 144ºW, and the eastern DPS consists of all Steller sea lions from breeding colonies east of 144ºW (62 FR 24345). In 1997, the western DPS reclassified as endangered and the eastern DPS retained its threatened status. The Eastern DPS was delisted in November 2013 (78 FR 66140).

6.1.15.1 Geographic Distribution

Steller sea lions are polygamous and use traditional territorial sites for breeding and resting. Breeding sites or rookeries, occur on both sides of the North Pacific, but the Gulf of Alaska and Aleutian Islands contain most of the large rookeries. Adults congregate for purposes other than breeding in areas known as haulouts. Based on extrapolations from non-pup (2008-2011) and pup (2009-2011) surveys, the minimum abundance estimate for the western DPS of Steller sea lions in Alaska is 45,916 (Allen and Angliss 2013). The population was generally stable from 2004 to 2008, despite considerable regional variability in trends (e.g., the population in the eastern Aleutians consistently increased, while the populations in the central and western Aleutians decreased) (Allen and Angliss 2013).

6.1.15.2 Critical Habitat

In 1993, NMFS issued a final rule designating critical habitat for the Steller sea lion, including all U.S. rookeries, major haulouts in Alaska, horizontal and vertical buffer zones around these rookeries and haulouts, and three aquatic foraging areas in north Pacific waters: Sequam Pass, southeastern Bering Sea shelf, and Shelikof Strait (58 FR 45269). This final rule was amended on June 15, 1994 to change the name of one designated haulout site from Ledge Point to Gran Point and to correct the longitude and latitude of 12 haulout sites, including Gran Point (59 FR 30715). Steller sea lion critical habitat has not been revised in conjunction with the 2013 delisting of the eastern DPS.

Critical habitat includes a terrestrial zone that extends 3,000 ft (0.9 km) landward from the baseline or base point of each major rookery and major haulout in Alaska. It also includes an air zone that extends 3,000 ft (0.9 km) above the terrestrial zone of each major rookery and haulout area measured vertically from sea level. Critical habitat within the aquatic zone in the area east of 144ºW extends 3,000 ft (0.9 km) seaward in state and federally managed waters from the base point of each rookery or major haulout area. Critical habitat within the aquatic zone in the area west of 144ºW extends 20 nm (37 km) seaward in state and federal waters from the baseline or base point of each rookery or major haulout area (NMFS 1993b).

Steller sea lion haulout and rookery sites that have been designated as critical habitat within the Area of Coverage are shown in Table 6-2. Currently, only two LTF facilities (Lookout Cove and Barefoot Beach LTFs – Figure 3) are operating west of longitude 144ºW. These facilities are located approximately 24 nm (44 km) from the closest designated critical habitat area.

TABLE 6-2. STELLER SEA LION HAULOUT AND ROOKERY CRITICAL HABITAT AREAS WITHIN THE GENERAL APDES PERMIT AREA OF COVERAGE

East of 144°W Longitude	Haulout or Rookery	Base Point		Boundary To	
		Latitude (ºN)	Longitude (ºW)	Latitude (ºN)	Longitude (ºW)
Benjamin I.	Haulout	58.56	134.91		
Biali Rock	Haulout	56.72	135.34		
Biorka I.	Haulout	56.83	135.57		
Cape Addington	Haulout	55.44	133.83		
Cape Cross	Haulout	57.92	136.57		
Cape Fairweather	Haulout	58.79	137.94		

TABLE 6-2. STELLER SEA LION HAULOUT AND ROOKERY CRITICAL HABITAT AREAS WITHIN THE GENERAL APDES PERMIT AREA OF COVERAGE

Cape Ommaney	Haulout	56.18	134.71		
Coronation I.	Haulout	55.93	134.28		
Gran Point	Haulout	59.13	135.24		
Graves Rock	Haulout	59.24	136.76		
Lull Point	Haulout	57.31	134.81		
Sunset I.	Haulout	57.51	133.58		
Timbered I.	Haulout	55.70	133.80		
West of 144°W Longitude	**Haulout or Rookery**	**Base Point**		**Boundary To**	
		Latitude (ºN)	**Longitude (ºW)**	**Latitude (ºN)**	**Longitude (ºW)**
Cape Barnabas	Haulout	57.17	152.92	57.13	152.92
Cape Chiniak	Haulout	57.58	152.15	57.63	152.15
Cape Gull	Haulout	58.23	154.16	58.21	154.18
Cape Ikolik	Haulout	57.28	154.79		
Cape Kuliak	Haulout	58.13	154.21		
Cape Sitkinak	Haulout	56.53	153.87		
Cape St. Elias	Haulout	59.80	144.60		
Cape Ugat	Haulout	57.87	153.85		
Chiswell Islands	Haulout	59.60	149.57		
Fish I	rookery	59.88	147.34		
Gore Point	Haulout	59.20	150.97		
Gull Point	Haulout	57.36	152.61	57.41	152.65
Hook Point	Haulout	60.33	146.26		
Latax Rocks	Haulout	58.70	152.48	58.68	152.50
Long I	Haulout	57.76	152.27		
Marmot I	rookery	58.24	151.79	58.17	151.85
Middleton I	Haulout	59.44	146.33		
Nagahut Rocks	Haulout	59.10	151.77		
Outer I	rookery	59.34	150.38	59.35	150.41
Perry I	Haulout	60.66	147.93		
Point Eleanor	Haulout	60.58	147.57		
Point Elrington	Haulout	59.93	148.23		
Sea Lion Rocks	Haulout	58.35	151.81		
Sea Otter I	Haulout	58.53	152.22		
Seal Rocks	Haulout/rookery	60.17	146.83		
Shakun Rock	Haulout	58.55	153.69		
Sud I	Haulout	58.90	152.21		
Sugarloaf I	rookery	58.88	152.03		
Takli I	Haulout	58.05	154.46	58.05	154.50
The Needle	Haulout	60.12	147.62		
Two-headed I	Haulout	56.91	153.55	56.89	153.59
Ugak I	Haulout	57.38	152.26	57.37	152.32

TABLE 6-2. STELLER SEA LION HAULOUT AND ROOKERY CRITICAL HABITAT AREAS WITHIN THE GENERAL APDES PERMIT AREA OF COVERAGE

Ushagat I	Haulout	58.92	152.37		

6.1.15.3 Impact Assessment

The APDES GP will not authorize any discharge of pollutants within 3 nm (5.6 km) of any major Steller sea lion haulout or rookery site, or within any Steller sea lion critical habitat area defined in 58 FR 45269, without written permission from the Regional Director of NMFS. In areas east of 144°W longitude, this restriction will exceed the 3,000 ft (0.9 km) criteria for critical habitat stipulated by NMFS (58 FR 45269). In areas west of 144ºW longitude, critical habitat includes an aquatic zone that extends 20 nm (37 km) seaward from the baseline or basepoint of each major rookery or haulout.

Adverse effects from LTF operations (see Chapter 5) are generally thought to be limited to an area that would not extend substantial distances beyond operations. Alterations to substrate and changes in the abundance and diversity of the benthic community are limited to the area receiving accumulations of bark and woody debris deposits. Potential reductions in water column DO concentrations arising from the decomposition of bark, woody debris, and leachates and potential toxicity arising from the release of leachates and petroleum releases are expected to be potential near-field effects that would be diminished with distance from the LTF site as local currents and storm events dilute and disperse impacted waters.

The APDES GP restrictions will require that LTF operations occur at distance that meet or exceed current critical habitat designations for Steller sea lion habitat. Based on these restrictions, it is concluded that LTF operations under the APDES GPs **may affect, but is not likely to adversely affect** this species.

6.1.16 Northern Sea Otter

The southwest Alaska DPS of northern sea otter was designated as threatened under the ESA on August 9, 2005.

6.1.16.1 Geographic Distribution

The northern sea otter (*Enhydra lutris kenyoni*) has a range that extends from the Aleutian Islands in southwestern Alaska to the coast of Washington state. The Southwest Alaska DPS range includes the Aleutian Islands, Alaska Peninsula, Kodiak Archipelago, Barren Islands, and the western side of lower Cook Inlet. The Southwest Alaska population of the northern sea otter is estimated to be 47,676 animals based on data collected between 2000 and 2004. The population estimate as of 2004 for the Kodiak archipelago was 11,005 sea otters (Allen and Angliss 2013).

6.1.16.2 Critical Habitat

Critical habitat for the Southwest Alaska population of northern sea otter was designated in 2009 (74 FR 51988). Northern sea otter critical habitat in includes waters from the mean high tide line to the 65.6-ft (20-m) isobath as well as waters within 328.1 ft (100 m) of the mean high tide line that occur within the range of the southwest DPS.

6.1.16.3 Impact Assessment

Northern sea otters are typically found in shallow water areas that are near the shoreline. They primarily feed in water less than 330 ft (100 m) in depth, and the majority of all foraging takes place in waters less than 130 ft (40 m) in depth. As water depth is generally correlated with distance to shore, sea otters typically inhabit waters within 0.6-1.2 mi (1-2 km) of shore (Riedman and Estes 1990).

The APDES GPs for LTFs in Alaska will not authorize any discharge of pollutants within critical habitat areas for northern sea otter. LTF operations are confined to nearshore waters, with most facilities operating in water depths less than 60 ft (18 m). Prey species of the northern sea otter in rocky substrate habitats typically include sea urchins, octopus, and mussels, while in soft substrates, clams dominate the diet. These prey species may be found in the vicinity of LTFs or prey upon other species that may be impacted by the alteration of bottom substrate by the accumulation of bark and woody debris. However, the limited areal extent of LTF accumulations of woody debris, the widespread distribution of available prey, and the mobility of sea otters would limit the impacts to this species.

The release of leachates and petroleum products from LTFs may cause toxicity that could conceivably affect the northern sea otter or their prey. However, these effects are most likely in close proximity to LTF operations as the chemicals causing toxicity would be diluted as they are dispersed by local currents and storm events. Petroleum spills, which could adversely affect sea otters, are infrequent at LTFs and generally involve only small quantities of petroleum products.

The decomposition of bark and woody debris and released leachates from LTF operations can exert an oxygen demand that may reduce DO concentrations in the sediments and overlying waters. The reduced DO concentrations could potentially adversely impact northern sea otter prey species either directly or indirectly by altering their food resources. These effects would likely only affect prey species in the vicinity of LTF operations and would be expected to have limited effects on sea otters due to the limited occurrence of LTFs and the widespread abundance of prey items at locations not impacted by LTF operations.

Based on an assessment of impacts to the northern sea otter, it is concluded that LTF operations under the APDES GPs **may affect, but is not likely to adversely affect** this species.

6.2 SUMMARY

This chapter evaluated the potential impacts to threatened and endangered species that may utilize waters near or within the Area of Coverage. A listing of each species and the potential impact level from LTF operations based on the above discussion is provided below.

- Upper Columbia River Spring Chinook NLAA
- Snake River Fall Chinook NLAA
- Snake River Spring/Summer Chinook NLAA
- Lower Columbia River Chinook NLAA
- Snake River Sockeye NLAA
- Lower Columbia River Coho NLAA

• Columbia River Chum	NLAA
• Hood Canal Summer Chum	NLAA
• Pacific Herring	May Affect Not Likely to Adversely Affect
• Short-tailed albatross	No Effect
• Steller’s eider	May Affect Not Likely to Adversely Affect
• Yellow-billed Loon	May Affect Not Likely to Adversely Affect
• North Pacific right whale	NLAA
• Sei whale	NLAA
• Blue whale	No Effect
• Fin whale	NLAA
• Humpback whale	NLAA
• Sperm whale	No Effect
• Steller sea lion	May Affect Not Likely to Adversely Affect
• Northern sea otter	May Affect Not Likely to Adversely Affect

7.0 COMMERCIAL, RECREATIONAL, AND SUBSISTENCE HARVEST

The determination of "unreasonable degradation" of the marine environment is to be made upon the consideration of the ten criteria listed in Chapter 1. This chapter provides information pertinent to consideration of the ocean discharge criterion listed below:

- **Criterion 7:** "Existing or potential recreational and commercial fishing, including finfishing and shellfishing"

This chapter provides a brief overview of the commercial, recreational, and subsistence harvests in Southeast and Southcentral Alaska. The chapter is organized by harvest type (commercial, recreational, subsistence). Discussions of marine fish and invertebrate harvests are emphasized because these harvests would be most susceptible to adverse impacts from LTFs. The potential impacts of LTFs on marine organisms were discussed in Chapter 5; they include habitat alteration, oxygen depression, and toxicity.

7.1 COMMERCIAL HARVESTS

The commercial harvests include finfish and shellfish harvests. The salmon fishery is the largest and most valuable commercial finfish fishery in Southeast and Southcentral Alaska. Pink, chum, coho, sockeye, and Chinook salmon are harvested using a variety of gear including purse seines, drift and set gill nets, and trolling gear.

The 2012 commercial harvest of salmon in Southeast Alaska and Yakutat was approximately 37.0 million fish with an initially estimated ex-vessel value of $157 million (ADF&G 2013a). The Area of Coverage also includes Prince William Sound, where 35.35 million salmon were harvested in 2012, and Kodiak Island where 20.2 million salmon were harvested in 2012 (ADF&G 2013b; 2012a). Pink salmon was by far the most numerous species of salmon caught in each of these areas, representing 57.6 percent of the salmon catch in Southeast Alaska and Yakutat, 78 percent in Prince William Sound, and 83.5 percent in Kodiak (ADF&G 2013a; 2013b; 2012a).

There is also a fishery in Southeast Alaska for groundfish species such as rockfish (*Sebastolobus* spp. and *Sebastes* spp.), lingcod (*Ophiodon elongates*) Pacific cod (*Gadus macrocephalus*), flatfish (e.g., *Platichthys stellatus*), and sablefish (*Anaploploma fimbria*). In 2010, the reported groundfish catch in Southeast Alaska was over 3.6 million round pounds with an ex-vessel value of almost $7.7 million. In 2010, sablefish accounted for 84 percent of the ex-vessel value of groundfish in Southeast Alaska (ADF&G 2011).

The commercial Pacific herring fishery in Prince William Sound was closed in 2012 for the thirteenth consecutive year because the spawning biomass was below the regulatory threshold (ADF&G 2013b).

Harvest figures and estimates of the ex-vessel value of invertebrate species included in the shellfish fishery in Southeast Alaska indicate that the most valuable commercial species are the geoduck (*Panopea generosa*), Dungeness crab (*Metacarcinus magister*), and golden king crab (*Lithodes aequispina*). The estimated value of the 2009 shellfish catch was $20.2 million in Southeast Alaska and $3.05 million in Kodiak (ADF&G 2009). Shrimp fisheries have occurred in the Kodiak Island, Prince William Sound, Southeast Alaska areas. The major pot shrimp fisheries occur in the Cook Inlet, Prince William Sound, and Southeast Alaska areas and usually total less than 500,000 pounds annually. Spot shrimp (*Pandalus platyceros*) are the primary species harvested within Prince William Sound and Southeast Alaska (ADF&G 1994).

No studies have been conducted with the intent of investigating potential impacts of LTF operations on commercial fisheries, and no adverse effects on fisheries have been reported. Most LTFs operate in shallow waters less than 60 ft (18 m) of depth. Adult Dungeness crab, Tanner crab, red and blue king crab, pink shrimp, coonstripe shrimp, humpy shrimp, and spot shrimp all can reside in shallow waters where most LTFs operate, and all species have planktonic life stages that may be found in shallow surface waters during this portion of their life cycle. Thus, these commercial species may be exposed to discharges from LTFs.

The Alaska Timber Task Force Guidelines contain siting and operational guidelines intended to prevent significant impacts to biological resources, including commercial fisheries. The general APDES permit has adopted these guidelines. The guidelines prohibit siting of LTFs within 300 ft (91 m) of the mouth of anadromous fish streams, or in important anadromous fish spawning or rearing areas. The guidelines also suggest that LTFs be sited in areas having the least ecologically productive intertidal and subtidal zones, and that they should not be sited on or adjacent to extensive tide flats, salt marshes, kelp or eelgrass beds, seaweed harvest areas or shellfish concentration areas. Adherence to these guidelines should minimize the potential for adverse impacts to commercial fisheries. Although there is no specific requirement to avoid demersal fish (groundfish) areas, the avoidance of biologically productive areas, if followed properly, should protect significant groundfish areas.

7.2 RECREATIONAL HARVESTS

A number of fish species are harvested by sport fishing in Southeast Alaska. A final environmental impact statement for the Tongass National Forest stated that 85 percent of all recreational fishing in Southeast Alaska occurs in the vicinity of the Tongass National Forest. Species commonly caught for recreation include salmon, trout, Dolly Varden, and herring. Recreational fishing in Alaska has steadily increased, generating important economic value for the communities of Southeast and Southcentral Alaska (USFS 2008).

As with commercial fisheries, strict adherence to the adopted Alaska Timber Task Force Guidelines, which are included in the general APDES permit for LTFs, should prevent adverse impacts to recreational harvests.

7.3 SUBSISTENCE AND PERSONAL-USE HARVESTS

An estimated 52.1 million pounds of wild food is harvested in Alaska, of which 38.3 million pounds is harvested by residents of rural communities. A substantial proportion of rural households harvest and use wild foods. For surveyed communities in different rural areas, from 92-100 percent of sampled households used fish, 79-92 percent used wildlife, 75-98 percent harvested fish, and 48-70 percent harvested wildlife (ADF&G 2010). The ADF&G Division of Subsistence regularly reports on subsistence activities within the different subsistence areas in the state. Three areas: Kodiak, Prince William Sound, and Southeast/Yakutat encompass the area included within the general APDES permit for LTFs. Subsistence harvests within these three areas are briefly summarized.

7.3.1 Kodiak Area

The Kodiak Management Area encompasses the waters of western Gulf of Alaska surrounding the Kodiak Archipelago and along that portion of the Alaska Peninsula that drains into Shelikof Strait between Cape Douglas and Kilokak Rocks. The major communities within the area include Akhiok, Chiniak, the Coast Guard Base, Karluk, Kodiak City, Larsen Bay, Old Harbor, Ouzinkie, and Port Lions. All communities are within the Kodiak Island Borough, which had an estimated population in 2012 of 14,239 (U.S. Census Bureau 2014).

Subsistence permits are required for the harvest of king, Tanner, and Dungeness crab. In addition to crab, other marine invertebrates used for subsistence purposes in the Kodiak area include clams, cockles, mussels, chitons, octopus, and sea urchins. The total reported Kodiak area subsistence salmon harvest in 2009 was 27,947 fish comprised of 78 percent sockeye, 16 percent coho, 4 percent pink, 1 percent Chinook, and 1 percent chum salmon (ADF&G 2012b). In 2009, 1,737 subsistence permits with harvest information were returned for the Kodiak salmon fishery. The 2009 subsistence salmon harvest was lower than the 5-year (2004; 33,147 salmon) and 10-year (1999-2008; 35,467 salmon) averages. There are no annual harvest assessment programs for other subsistence finfish fisheries in the Kodiak Management area. Fish harvested in the largest quantities, and used by the most households, include Pacific cod, lingcod, flounder, halibut, rockfish, and Dolly Varden.

7.3.2 Prince William Sound Area

The Prince William Sound Management Area includes all waters of Alaska between the longitude of Cape Fairfield and the longitude of Cape Suckling. In 2012, subsistence fishing permits were not required for marine finfish other than salmon. In the upper Copper River watershed, resident species such as grayling, burbot, and whitefish, among other species, are harvested for home use. Residents of Cordova, Chenega Bay, Tatitlek, Valdez, and Whittier take a variety of shellfish and marine finfish for subsistence use. The Prince William Sound Management Area personal-use and subsistence fisheries harvested a total of 231,000 fish in 2012. For these fisheries, approximately 12,400 subsistence and personal-use permits were issued to Alaska residents (ADF&G 2013b). In 2009, there were nine subsistence and personal-use salmon fisheries with annual harvest assessment programs in the Prince William Sound Management Area:

- Upper Copper River, Glennallen Subdistrict: state subsistence permit program
- Upper Copper River, Glennallen Subdistrict: federal subsistence permit program
- Upper Copper River, Chitna Subdistrict: state personal-use permit program
- Upper Copper River, Chitna Subdistrict: federal subsistence permit program
- Batzulnetas: a federal subsistence permit program
- Copper River Flats – Prince William Sound: state subsistence permit program
- Prince William Sound, Eastern District: state subsistence permit program
- Prince William Sound, Southwestern District: state subsistence permit program
- Prince William Sound, general area: state subsistence permit program

Salmon subsistence and personal-use fisheries data from 2009 are discussed below.

7.3.2.1 Upper Copper River District

This district consists of all waters of the mainstem Cooper River from the mouth of Slana River downstream to an east-west line crossing the Copper River approximately 200 yards upstream of Haley Creek. There are two subdistricts: Chitina Subdistrict and Glennallen Subdistrict. The total subsistence harvest in Glennallen Subdistrict in 2009 was 71,515 salmon, comprised of 95 percent sockeye, 5 percent Chinook, and less than 1.0 percent coho salmon. Pink and chum salmon are not generally available in the Upper Copper River, although a few chum salmon are sometimes reported. This total includes fish wheel and dip net harvests in the state-administered fishery; and fish wheel, dip net, and rod and reel harvests in the federally-administered fishery. The 2009 harvest was lower than the recent 5-year average (2004-2008; 83,323 salmon) and 10-year average (1999-2008; 78,686 salmon), but higher than the historical average (1989-2008; 66,464 salmon). A total of 1,364 permits were issued for Glennallen Subdistrict in 2009. Of these, 26 percent were held by residents of Copper River Basin communities and 74 percent were held by other Alaska residents (ADF&G 2012b).

The estimated total state-administered personal-use salmon harvest in Chitina Subdistrict in 2009 was 95,662 salmon, comprised of 98 percent sockeye, less than 1 percent Chinook, and 2 percent coho salmon. The 2009 estimated harvest for Chitina Subdistrict was the fourth lowest harvest since 1991, and well below the recent 5-year (121,424 salmon) and 10-year averages (120,133 salmon), as well as the historical average (1989-2008; 111,279 salmon). Of the 7,958 state permits issued in 2009 for Chitina Subdistrict, less than 1 percent were held by Copper Basin residents (ADF&G 2012b).

An estimated 1,560 salmon were harvested in the federal Chitina Subdistrict subsistence fishery in 2009, higher than the historical average (2004-2008) of 1,429 salmon. The 2009 harvest comprised of 98 percent sockeye, 1 percent coho, and 1 percent Chinook salmon. A total of 68 permits were issued, far lower than the historical average of 88 permits (ADF&G 2012b).

7.3.2.2 Baltzulnetas Fishery

This small district includes all waters from markers near the mouth of Tanada Creek and approximately one-half mile downstream from that mouth. It was created in 1987 through an emergency regulation to settle the United States District Court Case of John vs. Alaska No salmon were harvested from 2005-2009. The historical average (1987-2008) harvest for this fishery is 105 sockeye salmon, with the highest harvest occurring in 1994 with a take of 997 sockeye salmon (ADF&G 2012b).

7.3.2.3 Copper River District

This fishery is located at the mouth of the Copper River near the community of Cordova. In 2009, 323 permits were issued with a total estimated harvest of 2,173 salmon, comprised of 88 percent sockeye, 11 percent Chinook, 1 percent coho, and less than 1 percent chum salmon. The 2009 harvest was much lower than the 5-year (4,359 salmon) and 10-year (4,022 salmon) averages, but higher than the historical average (1965-2008; 1,386 salmon) (ADF&G 2012b).

7.3.2.4 Eastern District

This fishery is located near the community of Tatitlek. In 2009, 12 permits were issued for this fishery and four were returned. The reported harvest for 2009 was 170 sockeye and 131 coho salmon (ADF&G 2012b).

7.3.2.5 Southwestern District

This fishery includes the waters around Green Island. The primary participants in this fishery are the residents of Chenega Bay. In 2009, five permits were issued for this fishery and four were returned. The reported harvest for 2009 was 285 salmon, comprised of 59 percent sockeye, 9 percent coho, 2 percent pink, 30 percent chum, and less than 1 percent Chinook salmon (ADF&G 2012b).

7.3.2.6 Prince William Sound General Area

Since 1994, there have been only eight years when salmon harvests were reported for the Prince William Sound general area subsistence fishery. In 2009, one permit was issued and one was returned. The permit holder was from Whittier and that person did not harvest any salmon (ADF&G 2012b).

7.3.3 Southeast/Yakutat Area

The Southeast Alaska area extends from Dixon Entrance to Cape Fairweather. The Yakutat area extends from Cape Fairweather to Cape suckling. In 2011, the subsistence and personal-use salmon harvest in the Southeast Alaska area was 39,909 fish comprised of 79.6 percent sockeye, 12.4 percent pink, 4.4 percent coho, 2.7 percent chum, and 0.98 percent Chinook salmon. For the same year, the subsistence salmon harvest in the Yakutat area was 5,214 fish comprised of 73.6 percent sockeye, 17 percent coho, 7.2 percent Chinook, 2.2 percent pink, and 0.02 percent chum salmon (ADF&G 2013a).

7.3.4 Potential Impacts

The majority of subsistence harvest activities are devoted to the harvest of adult salmonid species. These fish are not likely to be adversely affected by LTF operations. The subsistence harvest of other nearshore shellfish and invertebrate species may be affected in localized areas in the vicinity of LTFs; however, given the small total area of LTF operations in relation to the available nearshore habitat, the impacts are expected to be insignificant. Habitat degradation of nearshore regions will be minimized by strict adherence to the adopted Alaska Timber Task Force Guidelines, which are included in the general APDES permit for LTFs, and should prevent adverse impacts to subsistence harvests.

7.4 SUMMARY

The primary commercial harvest in Southeast and Southcentral Alaska is for salmon, although other finfish and shellfish resources are also utilized commercially. These commercial harvests of fish and invertebrates are important to the economy of Alaska. Recreational harvests of several species of fish also occur. Subsistence harvests are important to many communities in Alaska.

Log transfer facilities have the potential to adversely affect fisheries resources through habitat (spawning, rearing, and feeding) degradation, degradation of water quality, and direct toxicity.

These effects should be minimized through proper siting of LTFs and adherence to the general APDES permit restrictions and best management practices.

8.0 COASTAL ZONE MANAGEMENT AND SPECIAL AQUATIC SITES

The determination of "unreasonable degradation" of the marine environment is to be made based upon consideration of the ten criteria listed in Chapter 1. This chapter provides information pertinent to consideration of the two criteria listed below:

- **Criterion 8:** "Any applicable requirements of an approved Coastal Zone Management Plan"
- **Criterion 5:** "The existence of special aquatic sites including, but not limited to, marine sanctuaries and refuges, parks, national and historic monuments, national seashores, wildness areas, and coral reefs"

This chapter addresses the requirements of the Coastal Zone Management Act and the Alaska Coastal Zone Management Program. In addition, the occurrence of special aquatic sites is noted.

8.1 COASTAL ZONE MANAGEMENT

8.1.1 Requirements of Coastal Zone Management Act

The Coastal Zone Management Act requires all federal agencies that carry out an activity within or outside the coastal zone that affects any land or water use or natural resource of the coastal zone to provide a consistency determination to the relevant State agency (Title 16 U.S. Code Section 1456, paragraph c, subparagraph 1, part C).

8.1.2 Status of Coastal Zone Management Planning

The Alaska Coastal Management Program was in effect from 1979 until it expired on June 30, 2011, by operation of Alaska Statutes 44.66.020 and 44.66.030. There is not currently an approved Coastal Zone Management Plan in Alaska.

8.2 SPECIAL AQUATIC SITES

The general APDES permit for LTFs in Southeast Alaska excludes coverage for discharges within the boundaries or within 1 nm of a State Game Sanctuary; State Game Refuge; State Critical Habitat Area; National Park, Preserve, or Monument; National Wildlife Refuge; or National Wilderness Area.

National and state game refuges, critical habitat areas, and sanctuaries include the following:

- National Parks

  Glacier Bay National Park

  Katmai National Park

- National Wildlife Refuges

  Alaska Maritime National Wildlife Refuge

  Kodiak National Wildlife Refuge

- State Parks and State Wilderness Parks

  Kachemak Bay State Park

Kachemak Bay State Wilderness Park

Afognak Island State Park

Shuyak Island State Park

- State Wildlife Refuges

Forrester Island Bird Refuge

Mendenhall Wetlands State Game Refuge

St. Lazaria Island State Game Refuge

Yakataga State Game Refuge

- State Critical Habitat Areas and Sanctuaries

Copper River Delta Critical Habitat AreaDude Creek Critical Habitat Area

Stan Price State Sanctuary

Tugidak Island Critical Habitat Area

- Kachemak Bay State Critical Habitat Area

8.3 SUMMARY

The permit prohibits discharges within 1 nm of federal and state special aquatic sites to protect these sites.

9.0 MARINE WATER QUALITY CRITERIA

The determination of “unreasonable degradation” of the marine environment is to be made on consideration of the ten criteria listed in Section 1.0. The following section provides information pertinent for the consideration of the ocean discharge criterion listed below:

- **Criterion #10:** Marine water quality criteria developed pursuant to CWA Section 304(a)(1).

Water quality standards for the protection of designated beneficial uses of the waters of the state of Alaska have been promulgated by the State of Alaska (Alaska Administrative Code 18 AAC 70). Marine water quality standards are established for the protection of designated uses of receiving waters. These uses are: (1) water supply (aquaculture, seafood processing, and industrial); (2) water recreation (contact recreation and secondary r ecreation); (3) growth and propagation of fish, shellfish, other aquatic life, and wildlife; and (4) harvesting for consumption of raw mollusks or other raw aquatic life. The standards provide minimum requirements that must be achieved for each possible pollutant under the above designated uses. The most stringent water quality standard for the designated beneficial uses is provided in Table 9-1. The APDES general permit for LTFs in southeast Alaska does not require regular monitoring of water quality parameters with the exception of oil sheen and annual bark monitoring surveys. Therefore, a comprehensive assessment of the compliance of LTF discharges with water quality standards is not possible. Potential water quality concerns for the discharges identified in Chapter 2.0 are provided below.

TABLE 9-1. ALASKAN WATER QUALITY CRITERIA FOR MARINE WATER

Criteria	Minimum Requirements (most stringent applicable)	Water Use
Residue (floating solids, debris, sludge, deposits, foam, scum, or other residues)	May not, alone or in combination with other substances or wastes cause the water to be unfit or unsafe for the use, cause a film, sheen, or discoloration on the surface of the water or adjoining shorelines, or cause leaching of toxic or deleterious substances, or cause a sludge, solid, or emulsion to be deposited beneath or upon the surface of the water, within the water column, on the bottom, or upon adjoining shorelines. May not cause detrimental effects on established water supply treatment levels. May not, alone or in combination with other substances or wastes, make the water unfit or unsafe for the use, or cause acute or chronic problem levels as determined by bioassay or other appropriate methods.	(A) Water Supply (B) Water Recreation (D) Harvesting for Consumption of Raw Mollusks or Other Raw Aquatic Life
Dissolved gas	Surface dissolved oxygen (DO) concentration in coastal water may not be less than 6.0 mg/l for a depth of one meter except when natural conditions cause this value to be depressed. DO may not be reduced below 4 mg/l at any point beneath the surface. DO concentrations in estuaries and tidal tributaries may not be less than 5.0 mg/l except where natural conditions cause this value to be depressed. In no case may DO levels exceed 17 mg/l. The concentration of total dissolved gas may not exceed 110% of saturation at any point of sample collection.	(A) Water Supply, (B) Water Recreation, (C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife, (D) Harvesting for Consumption of Raw Mollusks or Other Raw Aquatic Life

TABLE 9-1. ALASKAN WATER QUALITY CRITERIA FOR MARINE WATER

Criteria	Minimum Requirements (most stringent applicable)	Water Use
Turbidity	May not exceed 25 nephelometric turbidity units (NTU). May not cause detrimental effects on established levels of water supply treatment. May not reduce the depth of the compensation point for photosynthetic activity by more than 10%. May not reduce the maximum secchi disk depth by more than 10%.	(A) Water Supply, (B) Water Recreation, (C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife, (D) Harvesting for Consumption of Raw Mollusks or Other Raw Aquatic Life
pH	May not be less than 6.5 or greater than 8.5, and may not vary more than 0.2 pH unit outside of the naturally occurring range	(A) Water Supply (aquaculture) (C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife
Color	Color or apparent color may not reduce the depth of the compensation point for photosynthetic activity by more than 10% from the seasonally established norm for aquatic life. For all waters without a seasonally established norm for aquatic life, color or apparent color may not exceed 50 color units or the natural condition, whichever is greater.	(C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife, (D) Harvesting for Consumption of Raw Mollusks or Other Raw Aquatic Life
Fecal coliform bacteria	Based on a 5-tube decimal dilution test, the fecal coliform median MPN may not exceed 14 FC/100 ml, and not more than 10% of the samples may exceed a fecal coliform median MPN of 43 FC/100 ml.	(D) Harvesting for Consumption of Raw Mollusks or Other Raw Aquatic Life
Toxic and other deleterious organic and inorganic substances, for marine water uses	The concentration of substances in water may not exceed the numeric criteria for aquatic life for marine water and human health for consumption of aquatic organisms only shown in the *Alaska Water Quality Criteria Manual*, or any chronic and acute criteria established at 18 AAC 70, for a toxic pollutant of concern, to protect sensitive and biologically important life stages of resident species of Alaska. There may be no concentrations of toxic substances in water or in shoreline or bottom sediments, that, singly or in combination, cause, or reasonably can be expected to cause, adverse effects on aquatic life or produce undesirable or nuisance aquatic life, except as authorized by this chapter. Substances may not be present in concentrations that individually or in combination impart undesirable odor or taste to fish or other aquatic organisms, as determined by either bioassay or organoleptic tests.	(A) Water Supply (aquaculture) (C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife, (D) Harvesting for Consumption of Raw Mollusks or Other Raw Aquatic Life

TABLE 9-1. ALASKAN WATER QUALITY CRITERIA FOR MARINE WATER

Criteria	Minimum Requirements (most stringent applicable)	Water Use
Petroleum Hydrocarbons, oils and grease	Total aqueous hydrocarbons (TAqH) in the water column may not exceed 15 µg/l. Total aromatic hydrocarbons (TAH) in the water column may not exceed 10 µg/l. There may be no concentrations of petroleum hydrocarbons, animal fats, or vegetable oils in shoreline or bottom sediments that cause deleterious effects to aquatic life. Surface waters and adjoining shorelines must be virtually free from floating oil, film, sheen, or discoloration. May not exceed concentrations that individually or in combination impart undesirable odor or taste to organisms as determined by bioassay or organoleptic tests.	(A) Water Supply (aquaculture) (C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife D) Harvesting for Consumption of Raw Mollusks or Other Raw Aquatic Life
Sediment	Below normally detectable amounts.	(A) Water Supply (seafood processing)
Dissolved inorganic substances	Human-induced alteration may not cause a change in the water's isohaline patterns of more than ±10% of the natural variations, or the Maximum allowable variation above natural salinity is as follows: <u>Natural Salinity*</u> — <u>Human-Induced Salinity*</u> 0.0 to 3.5 — 1 Greater than 3.5 to 13.5 — 2 Greater than 13.5 to 35.0 — 4 ** parts per thousand*	(A) Water Supply, (C) Growth and Propagation of Fish, Shellfish, Other Aquatic life, and Wildlife, (D) Harvesting for Consumption of Raw Mollusks or Other Raw Aquatic Life
Temperature	May not cause the weekly average temperature to increase more than 1º C. The maximum rate of change may not exceed 0.5º C per hour. Normal daily temperature cycles may not be altered in amplitude or frequency.	(A) Water Supply, (C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife, (D) Harvesting for Consumption of Raw Mollusks or Other Raw Aquatic Life

9.1 RESIDUE

Residue is the water quality parameter that refers to “floating solids, debris, sludge, deposits, foam, scum, or other residues”. The criterion for this parameter is the water quality standard that applies to discharges of bark and wood debris from LTF operations. The most stringent water quality standard for this parameter is shown in Table 9-1. The potentially applicable aspects of the standards refer to the presence of sheens, water discoloration, leaching of toxic substances, and deposits of solids.

As discussed in Chapter 5, oil sheen monitoring is required under the current APDES General Permits. The incidence of sheens at LTF facilities over the twelve year period of 2000-2012 is low (seven reported events). The release of leachates from bark and wood debris may impart a yellow-brown coloration to the water based on information reported in the scientific literature; however, no coloration has been observed during dive monitoring surveys at LTF sites (Tetra Tech 2005). Exposure to leachates has the potential to be toxic to marine organisms; however, estimates of leachate concentrations near LTFs are well below concentrations that are reported to be toxic (Tetra Tech 2005). LTF operations can also result in the accumulation of bark and woody debris on the seafloor. The APDES General Permit requires that remedial actions are considered when the area of continuous bark coverage exceeds 1.0 acre and the thickness of wood exceeds 10.0 cm. A review of bark monitoring data shows that one LTF facility exceeded this threshold (see Chapter 2.0).

9.2 DISSOLVED OXYGEN

LTF permittees are not required to monitor dissolved oxygen; therefore it is not possible to determine compliance with state water quality standards. The decomposition of deposited bark and woody debris and released leachates can exert an oxygen demand that will reduce dissolved oxygen concentrations in areas where bark and woody debris accumulate (see Sections 5.1.3 and 5.2.2). Transport processes and local water circulation would be expected to mitigate oxygen depressions; however, low dissolved oxygen levels could be of concern particularly at LTF sites where circulation and water flushing are minimal.

9.3 TURBIDITY

The introduction of particles of bark and wood debris into marine waters in southeast Alaska could cause increased turbidity. The likelihood of high turbidity levels in receiving waters near LTFs is dependent upon the amount of bark and wood debris entering the waters and the sinking rate of the material. Although only limited information concerning the sinking rates of bark and wood debris is available, it is likely that sinking rates are fast enough to minimize the impact of bark and wood debris on turbidity. Any turbidity due to the introduction of particles of bark and wood debris to marine waters is likely to be extremely localized and would not cause waterbody-scale impacts to water quality.

9.4 PH

Laboratory studies have reported that the release of leachates can result in lower pH values (see Chapter 5.2.3). However, considering the relatively large buffering capacity of seawater (Pytkowicz and Atlas 1975), the release of leachates is unlikely to alter seawater pH values by more than 0.2 pH unit outside of the naturally occurring range. Any small changes that would occur would not be expected to exceed the pH standards (Table 9-1).

9.5 COLOR

The presence of large amounts of colored substances in waters due to bark and wood leachates has been documented in fresh water. Leachates have less effect on marine waters due to their precipitation (see Section 5.2.1). Diving surveys have not documented any increase in the coloration of marine waters (Tetra Tech 2005). It is unlikely that discharges from LTF operations will cause violations of water quality criteria regarding coloration.

9.6 TOXIC AND OTHER DELETERIOUS SUBSTANCES

Exposure to leachates has the potential to be toxic to marine organisms; however, estimates of leachate concentrations near LTFs are well below concentrations that are reported to be toxic. Furthermore, leachates tend to precipitate in marine water which also limits their toxicity potential (see Section 5.2.4).

A reduction in water quality due to the discharge of miscellaneous minor pollutants, which may release toxic compounds, is difficult to assess given the absence of any data. However, the effects from any releases would be expected to be confined to localized areas surrounding or down-current from the discharged items.

9.7 PETROLEUM HYDROCARBONS; OIL AND GREASE

Petroleum products discharged into marine waters may create an oil sheen on the surface of the water. Petroleum products may also contain toxic compounds listed by EPA as being priority pollutants. The nature and extent of any water quality degradation caused by petroleum products is dependent upon the composition and quantities of petroleum products discharged. Large discharges of petroleum products are not likely to occur at LTFs as a result of normal operating practices. Available data suggests that oil sheens associated with LTF operations are infrequent and generally associated with the accidental release of small quantities of petroleum products.

9.8 SUMMARY

Alaska marine water quality standards are applicable to pollutant discharges from LTFs in southeast Alaska. However, the absence of monitoring data for most pollutant parameters makes it difficult to ascertain compliance in a rigorous manner. Bark and wood debris discharges may create residue deposits, reduce dissolved oxygen concentration, and increase turbidity. Leachates may reduce dissolved oxygen concentration, lower pH, increase water coloration, and exert toxic effects on biota. The effect of miscellaneous minor pollutants on water quality is largely unknown, but localized impacts to aquatic organisms in the vicinity or down-current of individual LTF operations may be possible. Petroleum products could adversely affect water quality due to diminished aesthetic qualities, and the introduction of toxic compounds.

A review of discharges from LTFs suggests that reduction of dissolved oxygen concentrations from the decomposition of wood debris and leachates perhaps has the greatest potential to violate Alaska water quality standards.

The APDES general permit specifies BMPs that modify the water quality standard for residues. One LTF facility exceeded the NPDES permit one-acre threshold for continuous bark coverage and 10 cm bark thickness during the 2008-2012 monitoring period.

10.0 DETERMINATION OF UNREASONABLE DEGRADATION

Chapter 1 of this OCDE provides the regulatory definition of unreasonable degradation of the marine environment (40 CFR 125.121[e]) and lists the ten criteria which are to be considered when making this determination (40 CFR 125.122). The intent of this section is to briefly summarize information pertinent to the determination of unreasonable degradation with the respect to each of the ten criteria.

10.1 CRITERION 1

- "The quantities, composition, and potential for bioaccumulation or persistence of the pollutants to be discharged …," (40 CFR 125.122)

The four categories of pollutants likely to be discharged from LTFs within the Area of Coverage are: bark and wood debris, leachates, petroleum products, and miscellaneous minor pollutants.

The composition of bark and wood debris discharged from any given LTF is dependent upon the species of trees harvested for transfer. Species transferred at LTFs within the Area of Coverage may include western hemlock, Sitka spruce, red cedar, and yellow cedar. No information on the tree species transferred at LTFs is required to be provided under the APDES General Permit. Similarly, measurements of the amount of bark and wood debris discharged to receiving waters are not available; however, information is available to quantify the annual volume of logs transferred annually for active facilities. Annual monitoring data provides information on the areal coverage of bark and wood debris and the maximum thickness of wood deposits.

Eighteen shore-based LTFs were active during the five year period from 2008 through 2012, with only three facilities actively transferring logs during all five years. The number of individual facilities actively transferring logs during any given year ranged from seven to nine during the five year period from 2008 through 2012.

Year	Number of Active LTFs within the Area of Coverage	Total Annual Volume Transferred (MBF)
2008	8	90,237
2009	7	115,171
2010	9	130,786
2011	7	112,503
2012	9	117,120
Average 2008-2012	**8**	**113,163**

The maximum volume of logs transferred in any given year was 131 mmbf in 2010. This value represents the sum of the volumes reported for all facilities in 2010. The annual average volume of logs transferred at individual LTFs during the five year period from 2008 through 2012 ranged from 0.04 to 44.8 mmbf. The total volume of logs transferred over the five year period (2008-2012) at individual LTFs ranged from 0.2 to 224.1 mmbf, with nine facilities transferring total log volumes greater than 15 mmbf.

Bark monitoring survey data were available for 12 LTFs that operated for at least one year during the five year period of 2008 – 2012. The areas of continuous bark coverage for the active LTF facilities for which data were available ranged from 0.0 to 1.31 acres, with a median value of 0.12 acre. Bark and woody debris in the marine environment may persist for several decades after LTF operations have stopped. The extent of continuous bark cover is very small compared to the acres of state owned tidelands and submerged land in Southeast Alaska. The State of Alaska owns and manages nearly 2 million acres of tidelands and submerged lands within the boundaries of the Prince of Wales Area Plan (Department of Natural Resources, October 1998) alone. Tidelands are those lands from Mean High Water to Mean Lower Low Water (MLLW). Submerged lands begin at MLLW and terminate at the three nautical mile line offshore. The State also owns an additional 6,146,918 acres of tidelands within the boundaries of the Northern Southeast Area Plan and the Central/Southern Southeast Area Plan (http://dnr.alaska.gov/mlw/planning/). Not all of these lands are available for LTF activities.

The types of compounds in wood leachates include tannins, resins, oils, fats, terpenes, flavonoids, quinines, carbohydrates, glycosides, and alkaloids (Sedell et al. 1991). However, the specific composition and quantity of leachates released into receiving waters at LTFs are not well characterized. However, the potential for adverse effects from toxicity resulting from the release of leachates is thought to be negligible due to rapid biodegradation and precipitation reactions that remove leachate compounds from seawater.

The discharge of petroleum products into marine waters in southeast Alaska could adversely affect marine biota. The potential for impacts depends upon the characteristics of the petroleum products released and the magnitude and frequency of discharge events. Based on oil sheen monitoring reports provided over the period from 2000 through 2012, oil discharges from LTFs appear to occur infrequently, and with the exception of one boating accident, release small quantities of petroleum to marine waters (Tetra Tech 2005).

The quantity, composition, and persistence of miscellaneous minor pollutants discharged from LTFs are unknown. However, quantities discharged are likely to be relatively small and the environmental impacts of such discharges are expected to be minor.

10.2 CRITERION 2

- "The potential transport of such pollutants by biological, physical, or chemical processes …," (40 CFR 125.122)

The transport of pollutants discharged from LTFs within the Area of Coverage is discussed in Chapter 3. Transport of pollutants is affected by site-specific characteristics such as bathymetry, tidal currents, wind driven currents, and storm events. Modeling of the transport of bark and wood debris is complicated by the tendency for the material to float for a period of time before becoming waterlogged and sinking. Estimated volumes of bark and wood debris accumulated at some sites suggest that transport processes frequently affect the distribution of these materials. Annual bark monitoring surveys provide information on the amount of wood material in the vicinity of LTF operations. However, annual estimates of the amount of woody debris entering marine waters are not available; this information would be needed to determine the amount of woody debris that is transported away from individual LTF sites.

The transport of released leachates is not well characterized. Information in the scientific literature suggests that leachates tend to precipitate in marine waters and are subject to rapid biodegradation processes, and therefore are not transported long distances from woody debris deposits or log rafts.

10.3 CRITERION 3

- "The composition and vulnerability of the biological communities which may be exposed to such pollutants, including the presence of unique species or communities of species, the presence of species identified as endangered or threatened pursuant to the Endangered Species Act, or the presence of those species critical to the structure or function of the ecosystem, such as those important for the food chain …," (40 CFR 125.122)

Nearshore marine waters in the Area of Coverage typically support a diverse assemblage of marine life. Biological communities inhabiting coastal waters within the Area of Coverage are discussed in Chapter 4 and include planktonic organisms, benthic organisms, fish, shellfish, marine birds, and marine mammals. A number of species or distinct population segments (DPS) of fish, birds, and marine mammals that occur in the Area of Coverage are listed or are candidates for listing as threatened or endangered under the Endangered Species Act (ESA) of 1973. These species and DPSs are discussed in Chapter 6.

Adverse environmental effects on biological communities due to LTF may occur via several processes including burial under bark and woody debris, alteration of substrates, reductions in the ambient concentrations of dissolved oxygen in the interstitial pore water, and buildup of nonpriority pollutants such as ammonia and sulfides. Benthic organisms such as infauna, epifauna, epiflora, and demersal fish are most likely to be affected. The accumulation of bark and woody debris on sediments may cause substantial changes in the benthic community structure in receiving waters. Benthic organisms may be affected by burial, substrate alteration, and localized oxygen reductions. Leachates may cause localized oxygen reductions and sub-lethal and lethal toxicity to some organisms. Petroleum products introduced into marine waters could cause both lethal and sub-lethal effects on plant and animal species. Miscellaneous pollutants are likely to cause localized impacts that would be minor in comparison with other potential pollutant effects.

It is unlikely that any of the threatened or endangered species present within the Area of Coverage would be adversely affected by the discharge of materials from LTFs authorized under the APDES General Permit. Adverse impacts to these species' food supply are unlikely considering the limited expanse of impacts in relation to the species' total foraging area, the mobility of these species and their prey, and the limited amount of pollutants introduced as a result of LTF operations.

10.4 CRITERION 4

- *"The importance of the receiving water area to the surrounding biological community, including the presence of spawning sites, nursery/forage areas, migratory pathways, or areas necessary for other functions or critical stages in the life cycle of an organism …,"* (40 CFR 125.122)

Nearshore marine waters in the Area of Coverage typically support a diverse assemblage of marine life including plankton, algae, invertebrates, fish and shellfish, marine mammals, and birds. Detailed information regarding the presence of sites critical for spawning, nursery/forage areas, migratory pathways, and other important functions are not available. However, guidelines specified in the APDES General Permit do not permit LTFs to be sited in important habitat areas, or locations that are crucial for organism reproduction and migration.

10.5 CRITERION 5

- *"The existence of special aquatic sites including, but not limited to, marine sanctuaries and refuges, parks, national and historical monuments, national seashores, wilderness areas, and coral reefs."* (40 CFR 125.122)

Special aquatic sites in the vicinity of the Area of Coverage are discussed in Section 8.2 of this ODCE and include parks, refuges, sanctuaries, and critical habitat areas. The LTF siting guidelines and conditions included in the Post-85 General Permit are designed to avoid LTF construction and operation in these areas, and are adequate to protect special aquatic sites in the vicinity of the Area of Coverage.

10.6 CRITERION 6

- *"The potential impacts on human health through direct and indirect pathways ...,"* (40 CFR 125.122)

Humans that rely on recreational, commercial, or subsistence fish or shellfish harvests could be adversely impacted if LTF discharges adversely impact edible aquatic resources such as salmon and crab. Deposition of bark and woody debris could potentially reduce the availability of shellfish resources for human consumption, however, siting guidelines specified in the APDES General Permit would preclude substantial impacts to shellfish resources in most areas. Leachates are not expected to have substantial impacts on human health due to their tendancy for rapid dispersion and precipitation in seawater. It is possible that petroleum products released into the marine environment could be assimilated by humans through ingestion of contaminated fish or shellfish. The chain conveyor transfer method of log transfer has the greatest potential to release petroleum to marine waters during normal operations; only two LTFs are reported to be using this transfer method. Reported oil sheens are infrequent for active LTF facilities and the quantities of petroleum released tend to be small. There is a very low potential for discharges from LTF operations to result in seafood contamination at concentrations that would pose a threat to human health.

10.7 CRITERION 7

- *"Existing or potential recreational and commercial fishing, including finfishing and shellfishing ...,"* (40 CFR 125.122)

Commercial, recreational, and subsistence harvests of fish and shellfish species within the Area of Coverage are addressed in Chapter 7 of this ODCE. The potential impacts of discharges from LTF operations on marine organisms are discussed in Chapter 5 and include habitat alteration, oxygen depression, and toxicity. The Alaska Timber Task Force Guidelines contain siting and operational guidelines intended to prevent significant impacts to biological resources, including fisheries. The

APDES General Permit has adopted these guidelines. The guidelines prohibit siting of LTFs within 300 ft (91 m) of the mouth of anadromous fish streams, or in important anadromous fish spawning or rearing areas. The guidelines also suggest that LTFs be sited in areas having the least ecologically productive intertidal and subtidal zones, and that they should not be sited on or adjacent to extensive tide flats, salt marshes, kelp or eelgrass beds, seaweed harvest areas or shellfish concentration areas. Adherence to these guidelines should minimize the potential for adverse impacts to recreational, commercial, and subsistence fisheries. Although there is no specific requirement to avoid demersal fish (groundfish) areas, the avoidance of biologically productive areas, if followed properly, should protect important groundfish areas.

10.8 CRITERION 8

- *"Any applicable requirements of an approved Coastal Zone Management Plan …,"* (40 CFR 125.122)

The Alaska Coastal Management Program was in effect from 1979 until it expired on June 30, 2011, by operation of Alaska Statutes 44.66.020 and 44.66.030. There is not currently an approved Coastal Zone Management Plan in Alaska.

10.9 CRITERION 9

- *"Such other factors relating to the effects of the discharge as may be appropriate…,"* (40 CFR 125.122)

No other factors related to the potential discharges from LTF operations within the Area of Coverage have been identified.

10.10 CRITERION 10

- *"Marine water quality criteria developed pursuant to CWA Section 304(a)(1)."* (40 CFR 125.122)

Water quality standards for the protection of designated beneficial uses of the waters of the state of Alaska have been promulgated by the State of Alaska (Alaska Administrative Code 18 AAC 70). The Alaska marine water quality standards are applicable to pollutant discharges from LTFs. The evaluation of compliance with these standards is difficult because the existing NPDES General Permit for LTFs in southeast Alaska does not require regular monitoring of water quality parameters with the exception of oil sheen and annual bark monitoring surveys. Therefore, a comprehensive assessment of the compliance of LTF discharges with water quality standards is not possible.

The water quality criteria most likely to be affected by potential discharges from LTF operations include dissolved oxygen, pH, turbidity, coloration, and toxic and other deleterious substances. The decomposition of deposited bark and woody debris and released leachates can exert an oxygen demand that will reduce dissolved oxygen concentrations in localized areas near the deposits. Transport processes and local water circulation are expected to mitigate any effects of dissolved oxygen depletion; however, low dissolved oxygen levels could be of concern particularly at LTF sites where circulation and water flushing are minimal. The APDES General Permit includes siting guidelines intended to reduce the impacts of LTF operations in such areas. Laboratory studies have reported that the release of leachates from wood can lower pH. However, considering the relatively large buffering capacity of seawater (Pytkowicz and Atlas 1975), the release of leachates is unlikely to alter seawater pH values by more than 0.2 pH unit outside of the naturally occurring range. Any small changes in pH that may occur as a result of discharges from LTF operations would not be expected to exceed the pH standards. The introduction of bark and woody debris into marine waters could cause increased turbidity. However, any increases in turbidity resulting from the introduction of bark and woody debris would be localized and would not cause large-scale impacts to water quality. While the release of leachates can impart some coloration to waters, diving surveys have not documented any increase in the coloration of marine waters in the vicinity of LTF operations within the Area of Coverage and it is unlikely that discharges from LTF operations will cause violations of water quality for this parameter. Leachates and any petroleum products discharged from LTF operations could result in the addition of toxic or other deleterious substances to receiving waters. Considering the effects of dilution and dispersion due to local transport processes, the concentrations of such substances are not expected to exceed the most stringent applicable State of Alaska water quality criteria.

10.11 SUMMARY

The Ocean Discharge Criteria of particular importance in evaluating the discharges from LTFs within the Area of Coverage are those concerning the quantity, transport, and persistence of pollutants, and their potential for effects on biological communities (Criteria 1, 2, and 3). Bark and woody debris are the pollutants of most concern at LTFs within the Area of Coverage primarily because (1) bark and woody debris may persist for decades; (2) bark and woody debris may reduce the abundance and diversity of benthic infauna and eliminate habitat used by other organisms such as fish and mobile epifauna; and (3) decomposition of wood and released leachates exert an oxygen demand that may reduce dissolved oxygen concentrations.

Based on an assessment of the information and data presented in the proceeding chapters, a qualitative rating is provided on the potential for impacts to biological communities, human health, and water quality. The qualitative rating classifications used in this assessment are described below:

- **None** – No impacts from the discharged pollutant are anticipated.
- **Minimal** – There is evidence that this discharged pollutant might have a minor impact.
- **Moderat**e – Data from monitoring reports or the scientific literature suggest that this pollutant is likely to have an impact.
- **Substantial** – Data from monitoring or scientific literature imply that potential impacts resulting from this pollutant could be substantial.

The evaluations in Table 10-1 are based on best professional judgment given the scope of information available for the preparation of this document. As noted throughout this document, the measurement of discharges and monitoring of LTF operations is sparse, and the ability to determine transport of pollutants and compliance with applicable water quality parameters is limited.

TABLE 10-1. QUALITATIVE EVALUATION OF POTENTIAL IMPACTS RESULTING FROM OPERATION OF LTFS IN SOUTHEAST ALASKA

Discharge	Effect	Impact to		
		Biota	**Humans**	**Water Quality**
Bark and Wood Debris	Burial	Substantial	None	Moderate
	Alteration of substrate	Substantial	None	Moderate
	Reduced dissolved oxygen	Moderate	None	Moderate
Leachates	Increased water coloration	None	None	None
	Reduced dissolved oxygen	Moderate	None	Moderate
	Reduction in pH	None	None	None
	Direct toxicity	Minimal	Minimal	Minimal
Petroleum Products	Habitat alteration	Minimal	None	Minimal
	Direct Toxicity	Minimal	None	Minimal
	Toxics bioaccumulation	Minimal	Minimal	Minimal
Storm Water	Direct Toxicity	Minimal	None	Minimal
	Toxics bioaccumulation	Minimal	Minimal	Minimal
Miscellaneous Minor Pollutants	Alteration of substrate	Minimal	None	Minimal
	Direct Toxicity	Minimal	None	Minimal
	Toxics bioaccumulation	Minimal	Minimal	Minimal

Substantial impacts from LTF operations may arise due to direct burial of benthic organisms and through the long-term alteration of benthic sediments, which could influence the composition, abundance, and diversity of local benthic communities. These effects would be very localized and limited to areas where bark and wood debris accumulate on the seafloor. Based on data compiled to prepare this document and the results of bark coverage monitoring over the five year period from 2004-2008, no more than 7.15 acres of sediments in nearshore areas have continuous bark coverage at LTF facilities.

The decomposition of wood and leachates exert an oxygen demand that reduces dissolved oxygen levels in the sediments and overlying water column. Monitoring data is insufficient to determine whether dissolved oxygen concentrations at LTFs within the Area of Coverage meet the Alaska water quality standards numeric criterion for dissolved oxygen in marine waters. Potential impacts resulting from reductions in concentrations of dissolved oxygen were determined to be moderate. Water circulation and exchange at most LTF sites are expected to mitigate any effects of dissolved oxygen depletion that may occur at these sites.

Impacts from the discharge of petroleum products, storm water, and miscellaneous minor pollutants were determined to have “minimal effects” or “no effects” on the resources considered in Table 10-1.

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